JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. C., No. 2327.—TUESDAY, DECEMBER 17, 1907.

EDITORIAL NOTES—GAS, &c.

Relative Dangers of Gas and Electricity.

THE truth is not always palatable; and the truth about the part that electricity plays in fire-raising is not by any means palatable to electricians. They have shouted so loudly from housetops and in market-places as to the safety of their particular commodity, that, when brought to book, a platitude or a sneer and a feigning of injured innocence are the only methods of defending the character of electricity. Whenever a fire is conclusively known to have been caused by electricity, or circumstantial evidence admits of nothing but the conviction of electricity, still a pipe, a cigarette, and a match are fatuously arraigned as more likely delinquents. The attempts to wriggle from an uncomfortable position are interesting—and amusing; and the very nature of those attempts stamps them with a pitiful weakness. Yet the station engineer continues to try to gain custom by persisting in proclaiming in his literature that electricity in respect of fire is the safest of all illuminants; and it behoves the gas manager to see that people are not tripped up by a statement that to some may be specious enough to secure credence, seeing that there is no flame in connection with electric lighting and no matches required for ignition purposes. These very things are points in favour of the security of gas. There cannot be fire in which gas plays a part without the application of a flame to the gas; and there cannot be an escape of gas without smell. With electric lighting there can be fire without the deliberate application of flame; and there can be fire without any warning smell until the mischief is well started. No one can know the place nor the hour when a fire may be commenced by electricity. The very presence of a gas or match flame instinctively induces care. But all the care in the world on the part of the electricity user, and all the formidable rules and regulations for wiring premises, do not prevent conflagrations, and expensive ones too.

This question of the relative risks of gas and electricity is never referred to from the gas and commonsense point of view without calling down volumes of harmless wrath on one's head from the defenders of the blameless electricity. Herr Schäfer, of Dessau, had the temerity last year to collect and publish all the obtainable German statistics bearing upon the subject; and those statistics were conclusive of electricity having been a greater culprit than gas in causing fires in proportion to the extent of use, and in producing a greater destruction of property. A complimentary comment in our columns on Herr Schäfer's exercise incited one of our electrical contemporaries to make some vapid remarks, which were replied to by us, but no response has been made, though twelve months have passed. In Germany, a Herr Dettmar has made, as was seen in last week's issue, a wild assault on the excellent case framed by Herr Schäfer; and on every point it will have been remarked he left an open way for the originator of the cause of offence to make a happy reply, refutation of the points of which on the part of Herr Dettmar has not yet, so far as we are aware, found its way into print. In his attack, however, it will have been gathered that Herr Dettmar rejects official statistics, and he disputes methods of calculations and conclusions, with amazing freedom where they decline to aid him in his attack. Though official statistics are admittedly not above suspicion in the matter of completeness, we know of no other source to which one can go for such guidance as may be regarded as approximately true in this matter of the comparative safety of the two illuminants; and an invitation to the electricians to show a better source fails to elicit information. As a matter of fact, perhaps it is to the advantage of electricity that official statistics are incomplete, It must be very rare that gas, when the cause of a fire, escapes conviction; but with electricity the conditions are favourable to hiding all trace of its part in starting a conflagration. Experienced as he is in this matter, the opinion of Dr. Waldo, the Coroner for the City of London, must be respected; and in his view more fires are due to electricity than are actually attributed to it. And the formidable array, too, of rules and regulations that have been drawn up for the installation in premises of electricity is the best testimony to its destructive potentialities that could be devised. Herr Dettmar considers that such rules and regulations have in Germany brought about a "high immunity from "fire." But statistics attest the contrary; for, according to returns issued by the Royal Statistical Office in Berlin, fires caused by defective electrical wires show a gradual rise from 78 in 1900 to 199 in 1905. We may, however, suggest to Herr Schäfer the necessity, in considering these figures, of having regard to the increase in the number of electricity consumers. But the dogma of Herr Dettmar, as to a "high immunity "from fire" owing to the drafting of strict rules and regulations, would assuredly suffer a weakening if he had regard to the rules and regulations for electricity installation and their application in this country. Strict in definition, and comprehensive in extent, are the rules and regulations here; but there the strictness ends. There is no one to compel; there is no penalty for non-compliance. Competition inures to loose observance and cheap installation. And even where strict observance may be supposed to exist, occasionally reminders spring up that electricians have not brought electricity under positive control. Truly, the esoteric workings of electricity are a valuable protection to the electricity business. And who can blame the electricians for shielding themselves as much as possible behind those workings; and who too can blame gas managers for taking care that the public do not lose sight of the fact that they do so?

It is seen that Herr Schäfer has done us the honour of quoting certain of the calculations made in the third of our leaflets "Illuminating Truths for Householders" in connection with the 1906 returns as to electrical and gas fires (respectively 105 and 405) of the Chief Officer of the London Fire Brigade. Taking the 31 electricity undertakings in London (which undertakings lap over into districts not in the care of the London Fire Brigade, and this fact gives electricity an advantage), we found that in 1906 there was in their districts one officially recorded fire—this says nothing of those small ones dealt with privately—to every 760 electricity consumers. Taking only the consumers of the three London Gas Companies (which limitation again confers advantage on electricity), it was seen that gas was only responsible for one fire to every 2220 consumers. Herr Schäfer, however, also quotes the consumers of twelve Suburban Gas Companies; but there is little use in doing this, seeing that the districts of the Suburban Gas Companies, of the electricity undertakings, and of the London Fire Brigade are not coterminous. Only a part of those suburban districts come under the protection of the London Brigade. In assuming therefore that the 405 fires occurred within the area of the three Metropolitan Gas Companies we felt the calculation could not be challenged. But still Herr Schäfer makes no capital out of his addition of the consumers of the Suburban Gas Companies, seeing that he quotes our figure of one fire to every 2220 gas consumers, instead of one fire to 2945 as he could have done had he added the consumers of the Metropolitan and Suburban companies together, and divided the sum by the 405 fires. In considering this question of fire production in relation to the number of consumers, it would not be a bad thing to bear in mind the considerable connection of gas cooking and heating stoves in addition to points of lighting. In 1906, in the districts of the three Metropolitan Gas Companies there were no less than 600,000 hired gas stoves and fires, which take no account of the privately owned fixtures. Of such a number of electric cooking and heating stoves the electricity suppliers in London cannot boast—it would be a great joy to them if they could; but this consideration makes the calculation still more favourable to gas. The theory as to the use of matches for lighting

gas being a very prolific cause of fires is likewise disposed of by Herr Schäfer, who shows, by the fire statistics, that more conflagrations occur in rural districts through matches than in towns and cities where great quantities of gas are daily used.

Really the only instance of level-headedness that Herr Dettmar displays in his attack is where he expresses what is termed by our translator as his "pious aspiration" that statements respecting the danger to life and property inevitably accompanying the use of any artificial illuminant or heating agent should be eliminated from all documents of an advertising character. The electricians started by postulating on this matter; and so long as postulation is sufficient to occasionally hook a consumer, so long will they continue the old game. But Herr Dettmar sees far. More is known to-day about the evil behaviour of electricity than was known ten years ago; ten years hence more still will have accrued. That additional knowledge, at the rate we are progressing, may not be to the advantage of electricity.

Official and Administrative Parasites.

THERE appears to be still a great deal of misconception—ignorant or simulated—abroad as to the new Act for the better prevention of corruption embracing Christmas presents. The personal opinion of the Attorney-General is that Christmas presents to agents openly and honestly given as such cannot be brought within the Act; and the converse is equally true, that Christmas presents to agents that are not openly and honestly given do come within the purview of this punitive Act. In the gas industry, the greater number of Christmas presents that have in the past been distributed among the official agents of gas undertakings have not at any rate been openly given. On consideration, it seems almost a pity that the Attorney-General ever expressed any such opinion; for it is pretty clear that it will require a Court of Law to properly determine whether a Christmas present is both openly and honestly given, and openly and honestly received. A present might be openly given, but would it be honestly given if it infringed an Act designed to prevent giving for the purpose of securing undue favour? Moreover, it is quite obvious that the Attorney-General's expression of opinion opens the way to corrupt collusion—for example, between a Chairman and Directors or Committeemen and officials. Such men would be loth to let the shareholders or the ratepayers know that, in their fiduciary position, they had allowed the acceptance, and perhaps shared in, presents from firms with whom they were trading on behalf of the entire Company or the general body of ratepayers. We venture to think that a Law Court would not see much openness or honesty in such a proceeding; for it seems to us very doubtful whether Directors and Committeemen, who are themselves merely agents, have any right to sanction an act that can only have the one effect of inducing favour towards firms who give to the disfavour of those who decline to do so. Again, a firm may be informed by an "agent" that he has the consent of those whom he serves to receive Christmas presents. With the zig-zag line drawn through the Act by the dictum of the Attorney-General, the firm in such a case would be placed in an invidious position by doing what in self-defence they would be justified in doing—satisfying themselves that they were not being deceived. The Attorney-General has not by any means improved the position by his declaration.

In view of the dangers and uncertainties that encompass in this matter, it is best to keep well on the right side of the hedge, and have nothing whatever to do with the offering of Christmas gifts to agents, or with the acceptance by agents of gifts from those with whom they have commerce on behalf of their principals. However one looks at the matter, such gifts can only be given to encourage favour; if there was an interchange of these tangible evidences of "friendship" and "esteem," and the evidences had something of a commensurate value, the question would be placed on an altogether different level. That there may be danger in the Christmas present as between trading firms and agents is fully appreciated by many firms in the gas industry, some of whom have hitherto spent hundreds of pounds—in certain cases, the sums expended have turned four figures—on these annual gifts. And what for? Friendship, esteem, or favour? Let us not deceive ourselves. We are glad to see that the gas-stove manufacturers have unitedly resolved to stand firm (and we shall support them in the interests of purity in trading by going to the extreme of exposure if necessary) against what they know full well to have been a vicious system—a system that from its modest beginning was procreant, and grew luxuriously to large proportions in recipients, in supplicants for remembrance, and in the value of the gifts. Most other firms, too, in the industry have now resolved that it is better to keep on safe ground than have any dealings on the border lines of the unlawful. We much regret, however, to hear that firms are being already pestered by certain officials—and not only officials, but, to their disgrace, by those holding position in administrations—for some tangible consideration this Christmas time. Are these people ignorant of the new Act, or are their parasitical habits so strong that they would gratify them at the risk of punishment? We know that the giving of orders, and the hope expressed of being able to influence other orders, have within the last few weeks been urged as a reason why Christmas presents should be forwarded. Such correspondents of trading firms need to be reminded of the terms of the Act. The first clause says: "If any agent corruptly accepts or obtains, or agrees to "accept, or *attempts to obtain* for himself or for any other "person" . . . . he (to put the provision shortly) shall be guilty of a misdemeanour, and be liable to imprisonment for a term not exceeding two years, or to a fine not exceeding £500, or to both. Those who have written such letters have placed themselves in a position of great danger; they have put their character, liberty, and position into the keeping of other men. The safest protector of all three is a man himself, by blameless conduct in the eyes of the law. We warn those men whose names appear at the foot of letters, or on whose behalf letters have been written.

It is a pleasure to turn from such sordid behaviour to the attitude of many other officials, whose letters have been a great relief to the firms who have received them. Certain firms have—we hope that all who have been in the habit of sending presents have done so—received communications from officials of gas companies and local authorities, pointing out that, as the giving of Christmas presents is opposed to the spirit of the new Act, they must request that nothing of the kind shall in future be addressed to them. No firm would dare after such a request to violate the Prevention of Corruption Act which came into operation on Jan. 1 last, which, with Lord Justice Kennedy, we hope will do much to effect reformation. Speaking at the Gloucester Diocesan Conference just recently, his Lordship said: "Corruption "under the influence, to a considerable extent, of the in-"tensity of commercial competition had widely spread "from the kitchen of the private citizen to the offices of "big business houses. It was obviously a dangerous and "seductive form of immorality. Its ugliness was easily "disguised under the mask of generosity or gratitude." There is one Judge at least who will not be hoodwinked by any excuse of friendship, esteem, generosity, or gratitude. He at all events knows that commercial firms are not in the habit of spending what in the aggregate represent large sums of money in presents without expecting some return.

The New Specialist.

THE illumination engineer is a creature of Mr. Leon Gaster's vivid imagination. That gentleman long since advocated the formation in London of a Society of Illuminating Engineers similar to the one in New York; but, as we then told him, competition between the rival illuminants is so keen in this country that the likelihood of such a Society representative of the specialists of each lighting industry forming a compact and effective organization is very remote. Before the Society of Engineers-in-Charge, he has advanced his idea to the institution of a new profession—a profession of independent illumination engineers. To all who possess a private competency for maintaining a comfortable existence in this mundane sphere, hearty recommendation is given to Mr. Gaster's proposal; but to those among us who require a vocation that will furnish an income sufficient to preserve a safe distance from the bankruptcy court or the workhouse, that of the independent illumination specialist will not commend itself. The illumination engineer of Mr. Gaster's imagination must be a man of many parts and accomplishments; but there would be the difficulty of meeting the indispensable essential that such a specialist must be a man without any predilections in the matter of the means of obtaining illumination, and he must be a man who would keep himself clear of the provisions of the Prevention of Corruption Act, for his goodwill might be worth cultivating. We are afraid, however, that the house-

holder, the shopkeeper, and others are not educated up to the pitch of refinement that they will pay a man to advise them on the question of illumination, when every gas and electric supply authority keeps men who are qualified and prepared to give advice for nothing, though, after their advice is tendered, the householder, the shopkeeper, and others who have sought it, in many cases think themselves the more competent judges of their own needs, and go their ways, rejoicing in the result if a good system of gas lighting be adopted, and frequently, if electric lighting be favoured, rueing the day of determination when the bill for installation comes in, and the size of the quarterly account for electricity and renewals is seen. Supposing the institution of the independent lighting specialist, in these competitive days the suppliers of illuminating agents against whom his advice happened to go would make it their business to do their level-best to upset his recommendation. It may be suggested to Mr. Gaster that he himself should lead the way in coming out as a specialist in illumination (though we fear his judgment would be swayed by his electrical bias); and then tell us, after an experience of a year or two, what his personal view is as to the prospects of the new profession being a lucrative and promising one.

When, however, we bring to mind many electric lighting installations that have been seen, and which have been the recommendation of central station engineers, the thought occurs that a little more application of those fundamental principles of illumination that Mr. Gaster presents in his paper would be an advantage in the electrical industry. Those fundamental principles appear to be set at naught by station engineers in their anxiety to net business. Among other things, Mr. Gaster says that "an object is well illumi-"nated when it can be easily seen without fatigue or strain-"ing of the eyes." Some of the prescriptions put forward by electrical engineers for bringing electricity consumers' accounts down to the level of those for incandescent gas lighting (without having regard for equivalent illumination) do not suggest any anxiety on their part to avoid fatigue or straining of the eyes on the part of householders and their families. The knowledge of such station engineers as to "physiological optics" manifestly requires improvement. Going to the other extreme—shop-window lighting, "there "is," says Mr. Gaster "perhaps no other case in which "light is so effectively squandered. Brilliant lights are "frequently distributed either in front of the window or "among the contents of it in such a way that the prospective "customer cannot gaze into it without discomfort." Surely Mr. Gaster has in mind lighting by flame arc lamps. For shop-window lighting that is not an economical or an effective form of illumination; yet electrical engineers are unceasingly and mistakingly urging shopkeepers to adopt flame arcs. There is perhaps some satisfaction in knowing that this advocacy does not square with the ideas of Mr. Gaster. These instances of extremes in illumination, violating as they do the common-sense principles put forward by him, will probably be accepted by electricians as fair argument favourable to the institution in the electrical industry of specialists with the qualifications considered requisite by the author of the proposal now under notice.

The Italian Gas Worker: His Labour and Conduct.

Glancing over the world's gas industry, and considering the conditions in each country in regard to labour, we cannot find a more disheartening state of things existing for the administrators of gas undertakings than obtains in Italy. The workers are strong in organization; they have with them at the present time the sympathies of the Municipal and State Authorities, as opposed to reluctant consideration for the employer; the men are extremely sensitive, and on the slightest provocation innocently occasioned they will leave and attempt to disorganize work; their attitude is a watchful aggressiveness; their work is performed in slovenly manner; and in the carbonizing department the quantity they do in a day is of such modesty, that a good honest British stoker would hardly take the trouble to remove his coat to achieve it, and would certainly consider there was some mistake in his remuneration at the end of the week for the services he had rendered. Labour, in fact, in an Italian Gas-Works is the *bête noire* of the administration and the executive staff. Work is wanted for the purpose of earning wages; but labour, in heart, actively and deliberately sequestrates itself from, and is constantly at war with, the means of livelihood. It is not that labour is harshly dealt with. There is considerate treatment and good pay on all hands for the present, and liberal pension provision for the future. In this connection, the statements made by the Chairman of the Continental Union Gas Company (Mr. Arthur Lucas), at the meeting last Tuesday, will come as a revelation to many engaged in the home gas industry; and we can only say, after reading his dispassionate speech upon the dismal experiences of the last few months (which included a double strike, for which there was not the slightest need, so far as the Union des Gaz Italian stations are concerned), that labour must be very vulgarized by external conditions to take such inexcusable action when full consideration is extended to it as in this instance, and demands are met with the utmost reasonableness, and at heavy cost to the Company. For the condition to which labour has been reduced in Italy, the Municipal and State Authorities are greatly to blame; and Mr. Lucas in his speech was not by any means too strong in the terms and tone of his denunciation of the inertness of the Milan authorities in going to the Company's aid in the hour of their need to protect their property. If capital finds it cannot rely on protection in Italy, so much the worse will it be for the material future of the country. So far as labour is concerned, the Company have come to the end of their patience and their ability in the interests of the undertaking to make concession; and the men should take heed of this, and, if it be possible, adopt henceforth a reasonable attitude. It has become necessary for the Company to defend themselves as much as possible by resorting to mechanical operation; and for them there is capital value in spending money in adopting those methods that will give them some relief from perpetual labour trouble. Labour must be blind indeed if it cannot see that such tactics as have been witnessed at Milan must recoil, and result in permanent disadvantage. The strike at Milan was met by the Company's Agent (M. Lacombe), around whom the officers of the Company and men from other stations and countries rallied, with the mettle that was to be expected from such an organizer and honorable disciplinarian. We hope that Mr. Lucas's hint as to possible further troubles in Italy may prove merely a false impression produced by the shadows of recent events.

Department of Gas Engineering, Fuel, &c., at Leeds University.

With all that has been written regarding the new department of gas engineering, fuel, and metallurgy at Leeds University, nothing has been said that is likely to fire the desire of the student preparing for his life's work in the gas or kindred industries to participation in the opportunities offered by the new department so much as the description of the equipment (with sample views) that we have the pleasure of publishing in this issue. But to be in the buildings, and to see and to be among the assembled machines and instruments, alone serves as an inspiration, and produces a longing to be in a position to imbibe more information about the knowledge that conceived and brought them all into being, and to use them as means for realizing their lessons and for prosecuting the investigation that leads to expansion of individual and general knowledge. In the provision and equipment of the department, it will be seen how great is the indebtedness of all fuel-using industries to the Yorkshire coal-owners, and how comparatively little the gas industry is indebted to itself for what has been done there. But that is not to be any deterrent to participation. The department wants students; and we shall be greatly mistaken if those professionally engaged in the gas industry do not advise those who are proposing to train to succeed them to first go to, if fortunately means will permit, the Leeds University to learn of those fundamental truths upon which practice is constructed, and to so obtain the mental stimulus to greater practical effort than can be expected from the man whose training is entirely limited to the experience obtained from the daily routine of the works. Anything that has for its object the increasing of the efficiency of men should be welcomed. The equipment of the department gives an insight into the thorough and serious work that Professor Bone and his associates have in hand; and we hope to see it abundantly prosper.

The Promoters of the Bude Gas Company.

What on the first blush looked like a respectable prospectus was that issued last week under the title of the Bude Gas Company. It is a new Company formed under the powers of an Act

obtained last session. At the time the Bill was introduced, and afterwards, we had some suspicion as to its origin; and now that the prospectus has been published, and an appeal made to the public for within £13 of the total capital and borrowing powers allowed by the Act, it is seen that those promoters of certain unsubstantial (excepting in the matter of expended capital) gas companies, the Finance and Construction Company, Limited, are at the bottom of the undertaking, and propose by a contract to handle practically the whole of the capital now being sought from the public. The "Financial News" has been making some inquiry into this Bude promotion; and, among other points of interest, they give the information that the Finance and Construction Company was registered in Guernsey in 1905, with a nominal capital of £19,500; and in that year the principal shareholders were: Sydney R. Dennis, who held 30 ordinary £1 shares; Frederick Miller, with 50 shares; Charles H. Binney, who held 50 shares; A. B. Painter, who held 50 shares; and E. O. Preston and Co., who took the 200 £1 founders' shares. Our contemporary also states that it "learns that no agreements have been filed since registration. No return was made last January. In the return for January, 1906, 207 ordinary and 200 founders' shares were stated to have been taken." The people constituting this wretched concern are the ones who promoted the Bude Bill, and the people who (if the public responds to their invitation) are the only ones likely to make any substantial profit out of the statutory powers conferred last session. The Board of Trade have declined to allow Electric Lighting Orders being made marketable commodities by speculative firms; it is a pity Parliament does not look a little more narrowly into matters before dispensing their gifts.

The Capital of the New Promotion.

It is not the fault of the promoters of the new Company that they are not troubling the public for more money to supply the wonderful district of Bude and Stratton with gas. When the promotors went to Parliament, they asked for £15,000 of ordinary capital, and that was cut down to the £8500, which, with the sum represented by the one-third borrowing powers, is the total they can issue. The promoters are asking the public for the £8500 of ordinary capital and £2820 of debentures—together £11,320; and as the Finance and Construction Corporation have contracted to appropriate £10,300 for the purchase of the site for the works, for the construction of works, the laying of mains, for the payment of certain other costs, the provision of a sum to pay the interest and a dividend of 6 per cent. on the ordinary shares—the usual sprat with these people to catch a mackerel—and a sum (not stated) for working expenses, there will not be much of the authorized capital left. And whether or not a good business is obtained, the Company will, as certain as it is that it is the Finance and Construction Company at the bottom of this thing, be screwed-up for further capital before long, and without any authority, until Parliament is again approached, to obtain it. The prospectus states that the contract with the Finance and Construction Company can be seen at the offices of the Bude Gas Company. The humour of this everything-above-board kind of announcement is that the offices of the Company are at Queen Street, Bude. What a pity an office in Cannon Street was not made use of for the inspection of the contract; this would have been of great assistance to any people anxious to participate in the good fortune that (according to the prospectus) is simply waiting to be picked up at Bude and Stratton. Messrs. Willey and Co. are to be the contractors for the works; and no doubt they will be able to look after themselves better than those of the public who unfortunately think that investment in any company supplying gas must be safe.

The Art of Stating Prospects.

Reading the prospectus, the lay investor may be tempted to believe that never was there a district so ripe for gas supply. But it may occur to some that if the locality is of a character that will pay 10 per cent. on £8500 and 5 per cent. on £2820 (we should like to know something as to the nature of the manufacturing works and distribution plant and appliances that the Company are to get for their money, to see whether more capital is a probable early necessity), the Finance and Construction Company are most charitably disposed towards the general public. The Company, however, have a history in gas-works promotion; and in our pages may be found contributions to the chapters of that history. The Company's reputation is not likely to be improved by the present promotion. The "Financial News," as we have said, have been looking into this Bude promotion; and some scathing comments have been made on the highly coloured picture of the prospects. Bude is described in the prospectus as a seaside resort on the "Cornish Riviera," and it is said to be growing in importance. Our contemporary points out that the total population in 1901—counting every man, woman, and child—was 1367! The "market town" of Stratton is referred to as little better than a large village. The Bude Canal is stated to offer facilities for the cheap transport of goods. The heaviest load that can be carried up the canal is declared to be 4 tons; and the canal is really a "derelict affair." Then the usual table to show the profitable nature of gas investments is given—the towns quoted being those with populations of thousands, in some cases, many thousands, compared with Bude's 1367 in 1901. The prospectus also dangles before the public the experience of a suburban gas company who introduced slot meters as recently as 1901, and now quite 50 per cent. of the total number of consumers are supplied by this means, while the consumption of gas has increased by about 30 per cent. in the period. Bude with its total population of 1367 (in 1901) does not offer any very magnificent field for ordinary or slot consumers, not even, as our contemporary remarks, if every man, woman, and child had a meter. No one in the gas industry can now have confidence in anything the promoters of this Company touch; and the best thing we can wish is that they will burn their fingers severely over the present flotation.

ASSOCIATION OF WATER-WORKS ENGINEERS.

The Twelfth Winter Meeting of the Association was held last Saturday, in the apartments of the Geological Society, at Burlington House, W. For a winter meeting the attendance was excellent. The PRESIDENT (Mr. Christopher Sainty, of Windsor) was in the chair.

Minutes of Annual Meeting.

The PRESIDENT, in calling upon the Secretary to read the minutes of the annual meeting, said he was very sorry that he (Mr. Sainty) was not in such good health at that time as he was now; but he hoped the meeting did not suffer in consequence. He had, however, a very able Council to assist him; and the Secretary also did excellent work for him. He begged to tender his thanks to the Council and the Secretary for their kindness during that meeting.

The SECRETARY (Mr. Percy Griffith) then read the minutes of the meeting held at Windsor on June 6, 7, and 8, and of the subsequent visit to Paris, and they were unanimously approved.

Election of Office-Bearers, New Members, &c.

Mr. C. E. OXBROW and Mr. W. W. COSTER were appointed Scrutineers of the balloting-papers, and later they reported the following elections:—

President.—Mr. H. E. Stilgoe, City Engineer and Surveyor of Birmingham.

Vice-Presidents.—Mr. R. Askwith, of Bishop Auckland, and Mr. W. H. Humphreys, of York.

Members of Council.—Mr. H. Ashton Hill, of South Staffordshire Water-Works Company; Mr. A. B. E. Blackburn, of Sunderland; Mr. C. Clemesha Smith, of Wakefield; Mr. J. S. Pickering, of Cheltenham; Mr. G. Greenslade, of South Hants Water-Works Company; Mr. F. Griffith, of Leicester; Mr. E. Sandeman, of the Derwent Valley Water-Works: Mr. Easton Devonshire, of London; Mr. William Matthews, of Southampton; Mr. T. Molyneux, of Stockport.

Hon. Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

The following were the additions to the roll of membership:—

Members: Mr. A. E. Arney, of Perth, W.A.; Mr. Da. Kitchingman, of Poole; Mr. F. W. Macaulay, of Ludlow, Salop.

Associate Members: Mr. S. F. Deacon, of Heywood; Mr. I. E. Gooch, of Bridgend, Glam.; Mr. J. C. Hawkins, of Port Elizabeth, S.A.; Mr. H. F. Hill, of Ware, Herts.; Mr. R. W. Knapp, of Andover; Mr. G. T. Linnell, of Prestatyn; Mr. W. Simmons, of Buckley, Cheshire; Mr. S. J. Wilkes, of Lewisham, S.E.; Mr. H. P. Williamson, of Bamford.

Associate: Mr. W. R. Smith, of London.

Transfer: Mr. E. A. Borg, of Margate, from the class of Associates to membership.

Mr. H. E. STILGOE said he had to thank the members for the honour they had conferred upon him in electing him to be President of the Association during the ensuing year. At the moment, he could only say he should do all in his power to follow in the footsteps of previous Presidents, and to uphold the dignity of the Association and its usefulness. He trusted the members would give him their support; and, on his side, he should try to make the year a profitable one. He hoped, with the assistance of the Council, to be able to arrange a meeting in Birmingham which would be interesting and useful.

Papers Read.

The following papers were read and fully discussed:—

"The Water Supply of Malvern." By Mr. W. OSBORNE THORP, Surveyor and Water-Works Engineer of Malvern.

"Notes on the Water Supply of Paris and Suburbs." By Mr. EASTON DEVONSHIRE, Assoc.M.Inst.C.E.

"Underground Water: The Right of User in the Light of Recent Enactments." By Mr. A. B. E. BLACKBURN, B.Sc., Assoc. M.Inst.C.E., F.G.S.

The following paper was presented:—

"The Influence of the Thickness of the Pipe Wall on the Rate of Discharge of Water from Minute Orifices Piercing the Pipe." By Mr. W. R. BALDWIN-WISEMAN, M.Sc., Assoc. M.Inst.C.E.

The papers and discussions will be dealt with in subsequent issues of the "JOURNAL."

A Member from South Africa.

After the midday adjournment,

The PRESIDENT remarked that they had to welcome one of their old members back to England. That was Mr. W. Ingham who had left England to take up the water engineership of Port Elizabeth. He had arrived in London since members went to luncheon; and they were pleased to welcome him home again. (Cheers.)

Votes of Thanks.

The PRESIDENT proposed a hearty vote of thanks to the President and Council of the Geological Society for the use of their rooms for the meeting. The letter received from the Secretary of the Society, in response to their application, was such a charming one that the Council would not be backward in asking permission another year.

Mr. STILGOE, in seconding, said the members indeed appreciated the great hospitality and kindness extended to them by the Geological Society.

The motion was unanimously carried.

Mr. F. J. BANCROFT (Hull) proposed a vote of thanks to the authors of the papers; remarking that they had had magnificent papers, good discussions, and a splendid attendance.

Mr. S. R. LOWCOCK (London) seconded the motion; observing that he was pleased to be able to do so, as Mr. Thorp, points in whose paper he had criticized, might have thought he did not appreciate his contribution, because he did not say anything in the way of thanks. It appeared to him, however, that, when they had several papers, and such able and interesting ones as those they had had that day, and were hoping for good discussions, it was waste of time for every member to say to the author "we are obliged to you."

The motion was cordially agreed to.

Mr. EASTON DEVONSHIRE responded on behalf of himself and the other authors. They were, he said, gratified to find they had contributed matter which had given rise to excellent discussions.

Moved by Mr. W. MATTHEWS (Southampton), and seconded by Mr. W. G. PEIRCE (Richmond), the Scrutineers were also thanked for their services.

This concluded the proceedings.

The Buried Rivers of London.—This was the subject of a paper read at the meeting of the Auctioneers' Institute last Friday by Mr. J. G. Head. It was a topographical sketch suggested by the difficulties encountered in dealing with property owing to the presence of water in the soil. In the course of his paper, Mr. Head gave a description of the Holebourne, the Walbrook, and other watercourses, and mentioned that the Roman bath in Strand Lane still delivered 7000 gallons of water daily, and that the horse-trough in Cornhill was supplied by its own spring. He also stated that in the course of the excavations now in progress near the Bank of England for the new buildings of the Northern Assurance Company a wide stream was struck at a considerable depth—probably a tributary of the old Walbrook.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 863.)

THE prevailing tendency last week on the Stock Exchange was dull, with a shrinkage in prices, though at times an evanescent gleam would brighten things up a bit, but only to die out again soon. The chief depressing factor was, of course, in the Money Market. Hopes had been widely entertained that the Bank rate was bound to go down on Thursday; but it very soon became evident, from the drain of gold westward, that the thing was absolutely impossible. The state of affairs in the United States of America is very disquieting, and does not mend as it should. If it be true that the difficulty was engineered by the President's political opponents, they would seem to have won a third-term renunciation at a very heavy cost to the country. And such is Patriotism! However, on Monday the opening was flat in all departments—copper and other metal values being the chief influence. On Tuesday, things were as flat or flatter on the hardening of money; and the announcement of a failure was not reassuring. Fresh business was very quiet on Wednesday while the settlement proceeded; but high-class investments were firmer. There was a fair degree of recovery on Thursday. Advices from the United States were taken as a bull point; and an improved Bank return imparted a little cheerfulness. For the rest of the week business continued very quiet, with a dull tendency; but Consols remained unchanged, while most other prices shrank. The bad weather helped to depress Home Rails. In the Money Market, there was an abundant supply available at easy rates, which all demands were insufficient to stiffen. Discount rates hardened steadily up till Thursday, after which they took a turn the other way. Business in the Gas Market was a fair amount in the aggregate, and the bigger issues were active. Actual movements in price were irregular; but on the whole the indication denoted some firmness. In Gaslight and Coke, the ordinary was very brisk in the middle of the week, quieting down later, and made a further advance of a point—changing hands at from 93½ to 95. The secured issues were quiet; the maximum marking 87½, and the preference from 102 to 103. South Metropolitan was unchanged at the same figures as in the week before—viz., 120 to 121. The debenture was done at 82½. In Commercials, the 4 per cent. marked 102; the 3½ per cent. 98; and the debenture 81. In the Suburban and Provincial group, Brentford new was done at from 186 to 180 (a fall of 2), British at from 39½ to 40, Bromley "A" at 117, South Suburban preference at 120, and Wandsworth "B" at 129. The Continental Companies were extremely quiet. Imperial changed hands at from 168 to 169½, Union at 111⅛ *cum div.*, European fully-paid at 22½, and ditto part-paid at 17¼ and 16½. Among the undertakings of the remoter world, Bombay was done at from 6¼ to 6⅜, Buenos Ayres at 10¾, Oriental at 136, Primitiva preference at 5 and 4 15/16, ditto debenture at 92½ and 93⅛, and River Plate at 13⅝ and 13¼.

ELECTRIC LIGHTING MEMORANDA.

Fog from the Befogged as to Which is the Safest System of Electrical Installation?—Testimony as to there being no Present Perfection—Flexible Wiring—The Universality of Difficulty with Installations—Vague Statements from the Competitor.

ELECTRICIANS occasionally put the cart before the horse. Here is an instance. They have drawn up a set of rules and regulations, numbering some hundred or more, for guidance in the installation of electricity systems in dwelling-houses and other premises, with a view to the prevention of fire and shock; but they have not yet come to anchor as to which is the best system for the wiring of houses. Some favour one thing and some another, Some say that wood casing is a sufficient protection, others that metallic tubing is the right thing, others again advocate lead-covered wire, while opinions vary as to the application of flexible wiring. Faith vacillates. Wood casing, we are told, has nothing to commend it, except cheapness; and experience enables the statement to be fully endorsed with the utmost friendliness and freedom. On the other hand, wiring protected by metallic tubing—iron or steel—is expensive; and hitherto it has occasioned, although costing more than wood casing, a considerable amount of trouble and annoyance. But if we talk of these things as we find them, what is said is branded as prejudiced; and therefore we may quote the Sun Electrical Company as an authority on these matters, albeit, in doing so, we give the Company a free advertisement, which we hope they will properly appreciate. To be brief, the Company are running the "Kalkos" tinned brass tube system in preference to iron for the carrying of wires. The system, which is arrayed in the highest merit, has been on the market now for some ten years; but, strange to say, the other systems have not, as a consequence, abdicated in favour of the "Kalkos" method. In fact, we have heard more about the competing systems during the ten years than ever before. In the course of that period, however, the system has been used for the wiring of asylums and other important buildings—such as insurance offices and banks—"with an almost entire absence of trouble from wires failing."

Mark the ring of honesty about the words "almost entire." The system confessedly is not a complete success; but there is an "almost entire absence," &c. That is the system that the Sun Electrical Company prefer to all others.

Now not long since an electrical contemporary was telling us that, in its opinion, based on a long experience, "a screw pipe system or its equivalent will prevail"—that is to say, a pipe system in which the joints are mechanically made in such a manner as shall preserve complete electrical continuity. "From the po int of view of mechanical strength and safety from shock or fire," remarks the same contemporary, "experience *appears* to favour the solid piping system." We turn again from the utterances of our contemporary to the Sun Electrical Company's notes and general information on the demerits of all systems other than their own. And the question confronts us, Who has not experienced the annoyance, mortification, and expense of finding an installation carried out with the utmost possible care, and with the best obtainable materials, branded as a "failure," owing to mysterious faults, shorts, and earths occurring in the wiring? The answer is hidden in the recesses—if there are any—of every electrician's soul. What follows may be quoted on the authority of the Sun Electrical Company; and then if electricians want to quarrel with someone about letting people "into the know," regarding the frailties of the best advocated of wiring systems, they may go direct to the Company. This is what is written: "It was hoped at one time that, by improving the methods of jointing, substituting heavy screwed barrel for open joint slip-socket tubing, that all difficulties would be overcome, although, of course, at greatly increased cost. All to no purpose. At one time the trouble is attributed to faulty joints in the tubing through which water finds its way. When the joints are improved water still collects inside, and then the suggestion is made to drill holes at various places to let the water out. The fact remains, one may take all possible care, use the best material, and still run the risk of the wire failing, and frequently of being suspected of having done scamped work. In addition to the trouble due to wires failing, there is the further difficulty of securing continuous earthing. The danger of using metallic conduits, which may not be electrically continuous throughout their length and properly earthed, is now generally recognized, owing *not only to the fires, but to the still more serious loss of life which has occurred through their use.* The difficulty with the systems which have up till now been on the market has been to secure this continuous earthing. With slip-joint conduits it is hopeless to expect it. Heavy screwed barrel is expensive, requires costly screwing tackle, and owing to the large diameter of the sockets is very expensive in 'cutting away.'" Then moved by Mr. S. G. Castle Russell, of the Phœnix Fire Office, the "Electrical Contractor" has lately been eliciting the views of contractors as to which is the best method of protecting wiring. Among those who have replied are Messrs. Strode and Co., who consider the best system, *regardless of expense*, to be screwed solid drawn or welded heavy gauge steel barrel, with suitable draw-boxes where required, and outlet boxes at all lighting and switch points—all switch and fuse boards being iron cased, and all metal work galvanized. The user of electric lighting will see that this experienced firm are of opinion that the best system of protecting his property is to armour wires and fittings at all points. Another correspondent advocates the use in dry places or where there is no wet plaster, of strong American white-wood casing well varnished and painted; but, when wiring a new building or in damp places, he would use screwed steel conduit.

All this points to the fact that right up to the present, with rules and regulations bristling all round the contractor, there is no certainty of safety in the installations he puts in; and the installations that are described as the safest and the best are those that cost most money. Much, too, has been written of late about the use of flexible wiring. Ever since the fire at a certain South London drapery establishment, which caused a not inconsiderable loss, it has been a frequent subject of discussion. Some electricians deprecate the use of flexibles; others laugh at fears; others again cry out against alarming statements being made about this cheap and useful system of wiring for pendant lamps. The fact remains that serious damage and loss have arisen from the use of flexible. In the "Installation Topics" columns of the "Electrical Times," references have been made to the liability of flexible cords supporting pendants to fracture just above the cord grips; and mention is made of the fact that Messrs. Verity's Limited have brought out a device for preventing the risk of fire when a short-circuit due to such a cause takes place. We are not going to vouch for the surety of the declared prevention; but it is said that any ignition of the silk covering which might arise as a consequence of the fuse not blowing immediately the rush of current occurs across the short-circuit, will by the device be prevented from extending upwards along the flexible, and thus forming the nucleus of a serious fire. So we go on. In the hope of attaining safe conditions, the hapless electricity consumer must, the experience of more hapless consumers warns him, incur considerable additional expense; and then who among the experts is prepared to assure him, with a heavy forfeit attached to the assurance in the event of error, that he will suffer no evil from the installation. After all the discussion, we have still to ask which is most generally assumed to be the safest system of installation?

Troubles with electrical installations are universal, and not confined to England. The Cape Government have been issuing instructions that it is devoutly hoped will prevent accidents in connection with electricity installations; and attention is drawn to the matter by the "British South African Export Gazette." One short section of the instructions draws attention to dangers connected with the use of electric light in bath-rooms, and a special warning is given against the use of switches with brass covers and knobs, lamp-holders (known as key-holders), key switches, metal casing for wires, and flexible suspension cords. Brass knobs and covers and lamp-holders are objected to *in toto*; while it is advised that the other fittings referred to should be placed out of reach. Our Cape contemporary, while agreeing that a bath-room, with its damp floor, &c., offers a certain special danger of inadvertent shocks being administered, thinks the warning of the Government unnecessarily alarming, and likely to create prejudice against the domestic use of electric light, for the majority of people will not concern themselves with the distinction drawn between a bath-room and other apartments.

The Birmingham Corporation Gas Department have recently issued a circular in Handsworth, showing the comparative cost of private lighting by gas and electricity—the department being in competition with the electricity supply of the District Council. We noticed the circular in question three weeks ago (p. 662); and it will have been seen by the quotation we then made that Mr. G. Hampton Barber is not minded to let his department lose custom for the sake of speaking out plainly. Mr. Barber stated that electricity for lighting at 4d. per unit is several times more costly than an up-to-date system of lighting by gas at 2s. 6d. per 1000 cubic feet; and he pointed out that one ordinary incandescent gas-burner, used on an average of three hours a day throughout the year, and yielding an illuminating power of 65 candles, would only cost 12s. 4d.; while a similar volume of light from ordinary carbon filament electric lamps would cost £4 13s. 5d. This is one point out of a number made by Mr. Barber in his circular; and that circular has naturally been attacked, by vague and inconclusive statements, by the Handsworth District Council. It is said that Mr. Barber's circular compares the most efficient gas-burner with the least efficient electric lamp. We should be sorry if the gas-burner to which he referred was the most efficient. The least efficient incandescent gas-burner is that which gives only 65-candle power with a consumption of 4 cubic feet of gas per hour; and such a burner used for three hours per day would consume 4380 cubic feet in a year, which, at 2s. 6d. per 1000 cubic feet, works out to nearly 11s. for gas. Thus Mr. Barber's figure would allow 1s. 4d. for the maintenance of the burner; and quite enough too for a burner as ordinarily used in a house. That disposes of the point as to the cost of renewals not being taken into account. Then the Handsworth Council's circular states that the average illuminating power of an incandescent burner would be more nearly 30 candles. Very likely, for a common "C" burner, it would be, if the consumer allowed it to go on for ever without attention. It is, however, one of the conveniences of the gas-burner that it can be kept up by the consumer to the high-water mark of illumination. In the case of the electric lamp, he can do nothing of the kind, and moreover he is always very dependent upon what goes on at the generating end of the electric cables as to uniformity of illumination. One other point as to the least efficient electric lamp being taken for the comparison. We have not the slightest doubt that in Handsworth, the carbon filament lamp is the rule and not the exception among electricity consumers. The supply voltage at Handsworth is 240; and therefore if the electricity consumer employed the higher efficiency lamps, which can only be used singly on low-voltage systems, he would have to use the lamps in series—say, two at each point of lighting—and so his consumption of electricity would not be lessened, though his illumination would be greater. The initial and renewal cost of these lamps is much more than in the case of the carbon filament lamp; and it must be remembered that two of these lamps must be fixed where only one was placed before. The metallic filaments are very delicate; and most of the lamps can only be used in the vertical position. The Handsworth Electricity Department must be in a very bad way when they publish such an obviously foolish statement as this: "Gas consumes the oxygen of the air, and replaces it with a poisonous gas." Gas consumers, we believe, are still to be found living at Handsworth; and the use of a bunsen flame with a mantle over it surely does not put Nature's work all awry. Let the gentleman who penned the senseless statement on behalf of the District Council just consider whether such a terribly noisome illuminant ought not to have caused his own premature removal from the face of the earth. Let us have no more nonsense of this kind. But let the Electric Lighting Department of Handsworth tell us first what are these poisonous and mischievous products that an incandescent gas-burner gives off, and, secondly, something about the quantity. Then we shall be in a better position to discuss the question with them.

Gas-Engines for Ships.—A four-cylinder gas-engine of 60-h.p., has been installed with great success on the *Ameise*, one of the tugs on the Volga River, according to the "Zeitschrift für Maschinenbau." The boat is 24 metres long by 365 metres beam and 2·4 metres depth. On the trial trip, the distance from Saratov to Astrachan, 1200 kilometres (845 miles), was covered in 52 hours. Russian anthracite coal was burned. The gas-engine, which also drove the dynamo for the electric lighting of the ship, is stated to have worked very economically.

PERSONAL.

At the last ordinary monthly ballot of the Institution of Civil Engineers, Mr. PERCY DOUGALL, son of Mr. A. Dougall, the Manager of the Kidderminster Gas-Works, was admitted an associate member.

We are pleased to learn that Mr. CHARLES AIRD WATSON has recently been appointed Manager of the Charters Towers (Queensland) Gas-Works—he having succeeded in this position Mr. HUMPHRIES, who resigned. Mr. Watson is a member of a family who have been well known in connection with gas engineering both at home and abroad for the past fifty years. His brother, Mr. James C. Watson, is the Engineer and General Manager of the Oriental Gas Company at Calcutta.

Mr. JAMES CAMPBELL, the Manager of the Polmont Gas Company, has been appointed Manager of the Bo'ness Gas Company, Limited, in succession to the late Mr. John King. There were about fifty applicants for the post. Mr. Campbell was for a number of years employed in the Dunfermline Gas-Works. In December, 1905, he was selected for the position of Manager at Polmont, where a new Gas Company had been formed. He erected the gas-works, and has superintended them ever since. It may be remembered that last July he read before the North British Association of Gas Managers a paper in which he gave his experiences in the opening up of a new gas supply.

At the Manchester Hotel, Hull, a few evenings since, Mr. and Mrs. J. C. MANN were the recipients of presents by the office and works staff of Messrs. Major and Co., Limited, tar distillers and chemical manufacturers, of Sculcoates, in testimony of their esteem and respect for Mr. Mann, who has relinguished his position as Works Manager after holding it for ten years. The gifts consisted of an onyx clock and bronzes and a gold bracelet, both suitably inscribed. In acknowledging them, Mr. Mann expressed his appreciation of the motive which had prompted their presentation; and he assured the donors that he was leaving them with many regrets, as he was parting with some excellent friends. He thanked them for their remembrance of his wife, who, he said, had been of great help to him in carrying out his work. In conclusion, he said he had only tried to do his duty to them all; and he felt that the evening's proceedings had proved that he had succeeded.

OBITUARY.

Mr. GEORGE TAYLOR, the Manager of the Jedburgh Gas Company, died at his residence in that town on Friday last, at the age of 72 years. Mr. Taylor was a native of Leith, and received his business training in the gas-works there. He had been about forty years in Jedburgh. For a long time he was Secretary of the Waverley Association of Gas Managers, but retired from the office about twelve years ago. After that he attended very few meetings of gas managers. He was a gentleman of much firmness of character, and bore in his countenance the impress of thoroughness and uprightness.

Warrington has suffered the loss by death, within 48 hours of each other, of two Aldermen—Mr. JAMES FAIRCLOUGH and Mr. RICHARD W. FRANCOMB—both ex-Mayors, and for many years prominent public men. Mr. Fairclough was for a long period Chairman of the Gas Committee, and of the Finance Committee, and Deputy-Chairman of the Rivers Committee. The waterworks were purchased during Mr. Francomb's mayoralty; and he was elected Chairman of the Purchasing Committee, and was subsequently appointed the first Chairman of the Water Committee to carry on the works as a Corporation undertaking.

We regret to record the death, last Tuesday evening, at his residence in Stoke Newington, in his 66th year, of Mr. HENRY BURTON CHAMBERLAIN, the Secretary of the British Gaslight Company, Limited. Deceased entered the Company's service in June, 1861, and was appointed Accountant in 1868. This position he held till March, 1897, when, on the relinquishment by Mr. Frederic Lane Linging of the secretaryship, he was appointed to succeed him. Mr. Chamberlain had not of late been in good health; but he attended the last general meeting of the Company in September. He was a member of the Committee of the Gas Companies' Protection Association; and was also a Freemason for many years. He was a member of the Earl of Zetland and Mount Sion Chapters, was twice W.M. of the Earl of Zetland Lodge, and a member of the Evening Star Lodge. He leaves a widow, five sons, and three daughters. His sons are all connected with the gas industry. Mr. H. B. Chamberlain is the Engineer and Manager of the Trowbridge station of the Company with which his father was connected for so many years; and Mr. E. B. Chamberlain is the Assistant Accountant in their chief office. Mr. F. W. Chamberlain has lately retired from the service of the Bombay Gas Company, in which he held the position of Engineer; Mr. S. F. Chamberlain is one of Messrs. Thomas Glover and Co.'s representatives; and Mr. Horace Chamberlain is an assistant at the British Gaslight Company's Hull station. The interment took place yesterday, at the City of London Cemetery, Ilford; a funeral service being previously held at St. Michael and All Angels' Church, Stoke Newington Common. Deceased was well known in the ranks of the gas profession; and he will be greatly missed, especially by the Company's staff of all grades, by whom he was held in very high respect.

THE FRANCO-BRITISH EXHIBITION PROGRESSES

IN spite of the unfavourable weather which prevailed last Thursday, when rain fell for about twenty hours out of the twenty-four, something like 700 ladies and gentlemen accepted an invitation to meet Lord Selby and other members of the Executive Committee at the Franco-British Exhibition, and view the progress made. The guests were received in the Palace of Women's Work, now approaching completion; and parties were formed for a tour of the grounds, which was made possible by the laying of boarding over the entire route. Starting from the meeting-place, in charge of a guide, the visitors were shown successively the Franco-British Pavilion (the decorative columns of which are by French artists), the spacious Machinery Halls, one of which will contain the gas exhibits, the sites for the Canadian and other Colonial Halls, the two ends of the great Stadium, where the Olympic games are to be held, and the Fine Arts Palace. The Machinery Halls constitute a very fine block of buildings; and it was stated that so numerous had been the applications for space that extensions had twice been called for. Probably the greatest interest was shown in the Stadium, which, when finished, will hold about 70,000 people. In spite of the rain, many of the visitors, including ladies, mounted to the upper tiers of seats to get a view of the vast area in which the sports will be held. However attractive may be the other features of the exhibition, this will probably be the chief—the "*clou*," to borrow a word from our neighbours and colleagues. Of course, a vast amount of work has to be accomplished before the buildings are ready for their contents; for in several cases only their skeletons are at present visible. Others, however, are in a sufficiently forward state to justify the expectation that they will be ready early in the New Year. So far as could be judged under the adverse meteorological condions of Thursday afternoon, they will be by no means deficient in beauty. With the activity prevailing in all departments at Shepherd's Bush, the work of the next two months should show visitors what the remainder will look like.

As our readers are aware, the Gas Section of the exhibition is in the hands of an influential Committee, of which Mr. H. E. Jones is Chairman, and Mr. J. W. Helps, of Croydon, is Honorary Secretary. In the letter which appeared in the last number of the "JOURNAL," Mr. Helps set forth the proposals of the Committee in regard to making the display of gas appliances as attractive and useful as possible, and defraying the cost of the undertaking. These matters were fully dealt with in the editorial columns in the same issue, and therefore need not be further alluded to now. But it may be pointed out that the electricians will do their utmost to make an effective display; and they will be in a good position for doing it. According to the plan of the site, the Hall of Electricity will confront all the visitors passing into the exhibition from the Wood Lane station entrance; and at a meeting held at the Hotel Cecil last Thursday, in connection with the Manchester Electrical Exhibition, Dr. Glazebrook expressed the hope that, as the gas companies were combining for the purpose of making a very strong and effective exhibit at Shepherd's Bush, the members of the electrical industry would co-operate with each other to present a display of the uses of electricity for all purposes. Mr. Cunliffe Owen also spoke to the same effect, and, according to the "Electrician," said that "if the electrical trade would only combine to do something really worthy of the industry, they would find that the supply companies would support in every possible way." The speaker's concluding words closely touch the subject dealt with in the latter portion of Mr. Helps's communication.

With regard to other matters with which our readers are concerned, it may be remembered that the London County Council have decided not to incur any expense in erecting a pavilion for the exhibition of examples of municipal work. The French Municipality, however, will have one in the open space to the rear of the Franco-British Pavilion, and in close proximity to the Machinery Halls. In it will be displayed, so far as has at present been arranged, objects of historical interest connected with the City of Paris, together with plans, models, and the literature of municipal work and improvement undertaken by the Council. Those of our readers who visited the Paris International Exhibition of 1900 will doubtless recollect the interesting display made by the Municipality in their pavilion; and as their collection at Shepherd's Bush will be conveniently located for a visit on the way to or from the Gas Section, those of our readers who are concerned with water supply and sanitary work will doubtless take the opportunity of inspecting it.

The Nobel Prize for Chemistry, which it was announced would probably be awarded to Sir William Crookes, has been given to Dr. Buchner, of Berlin. Its value is about £7620; and the recipient has also a diploma and a gold medal.

THE PHYSIOLOGICAL BASIS OF ILLUMINATION.

An interesting contribution to the proceedings of the American Academy of Arts and Sciences has been made by Dr. Louis Bell, on the subject of "The Physiological Basis of Illumination." In this a clear statement is given of the various factors which physiologically affect the power of sight. It is remarked that, while the data relating to the subject cannot rank with exact physical measurements, they can be evaluated closely enough to be reliable.

The author states that the faculty of seeing things is chiefly due to differences of colour and of luminosity. Practically, vision depends very largely on the power of distinguishing differences in the latter quality; and since objects in general are luminous only in virtue of light reflected from them, their visibility depends in turn upon the co-efficients of reflection. The fundamental fact at the basis of vision is that the eye can, within a very wide range of absolute intensity, perceive a substantially constant fractional difference in luminosity. The numerical value of the fractional difference, known as Fechner's fraction, is for normal eyes and ordinary intensities from 0·02 to 0·0055. The importance of Fechner's law in practical seeing is enormous; for in a room well lighted by diffuse daylight, the illumination may vary from 100 metre-candles* down to 10 or 20 in different parts of the room or at various times; and if the power of discriminating difference of luminosity changed much with the illumination, one would be purblind most of the time. Dr. Bell mentions the case of a patient who was unable to get about in full daylight without stumbling; the cause being defective vision due to the fact that the Fechner's fraction in his particular instance stood abnormally at 0·1.

The difficulty due to increased fractions is such that if it was as high as 0·5 no contrast less than that between white and very dark pigments could be easily distinguished. While Fechner's fraction is fairly constant over a wide range of intensities, the power of discriminating shades is seriously impaired as twilight deepens. It is this variation of the fraction with the illumination which determines the minimum of artificial light necessary to see things *en masse* in their natural relations. For general vision any illumination above that required to bring Fechner's fraction for the normal eye up to its steady value is needless, and may be injurious. Human vision, however, is frequently concerned with the observation of fine details; and the power of seeing these is within wide limits independent of the capacity of the eye for distinguishing small differences of luminosity. This visual acuity seems to depend on the structure of the retina and the quality of the eye as an optical instrument, rather than on the direct or secondary sensitiveness of the nerve endings to stimulation by light. The author deals with some physiological investigations in the matter, and then proceeds to point out that enough light in artificial illumination must be provided to bring the eye to its normal acuity as well as to its normal value of Fechner's fraction. By a curve diagram it is shown that the acuity and shade perception tend to become fairly good even at low values of illumination, and are almost regular at about 10 metre-candles. When the light reaching the eye has risen to 10 to 20 metre-candles, further increase does very little in the way of assisting practical vision. Artificial illumination can safely be based on this amount as a working intensity.

The author states that it should be understood that, in specifying 10 to 20 metre-candles as the intensity physiologically necessary to bring the eye into its normal working condition, these intensities are those which become visible to the eye, and not merely those that reach the object under observation. Visual acuity is the controlling factor in most indoor lighting. It varies noticeably with colour; but for practical reasons, the actual visibility of coloured objects depends more upon their general light-reflecting power, which for dark hues, it is pointed out, is always low.

Some examples of the effect of reflection are given, and Dr. Bell then proceeds to deal with the influence of the pupillary aperture. Data on the actual relation between intensity of incident light and the opening of the pupil are scarce and imperfect —so much depending on the state of the adaptation of the eye, individual sensitiveness, and probably the intrinsic brightness of the source. The author, however, plots a curve, from a reduction of Lambert's data, with the illumination in metre-candles as abscissæ, and the area of the pupil in square millimetres as ordinates. The diagram shows the pupillary opening rapidly contracting from about 70 to 13 or 14 sq. mm. for illuminations rising from *nil* to something like 7 metre-candles, after which the contraction is relatively much less, becoming about 5 sq. mm. only as the light reaches 50 metre-candles. From this the author infers that the contraction and expansion of the iris is less to protect the eye at high intensities than to strengthen the retinal image at low intensities, even at the expense of considerably impaired definition. Human eyes seem, however, to have become specialized for considerable acuity in moderate light.

The gain from increased aperture has to be taken into account in dealing with the visual acuity and the Fechner fraction at low illuminations; and this gain is important in practical vision. Were it not for this assistance, it would be exceedingly difficult to get about at night. Taking, for instance, moonlight at 0·2 metre-candle, the Fechner fraction would be nearly 0·5; but with the aid of the pupillary aperture enlarged some six times, one can see to get about easily, and even to read large print. Dr. Bell also deals with the effect of bright light upon the pupillary aperture, and suggests that the eye has been evolved under conditions which imply rather moderate intrinsic brilliancy. The chief difference between natural and artificial illumination from the standpoint of wear and tear on the visual organs is the high intrinsic brilliancy of artificial light; and he emphasizes the necessity of screening any bright radiants which are in the field of vision. The eye works most efficiently at moderate illumination. The adverse factors in lowering the illumination are the optical errors introduced by increase of pupillary aperture and the general failure of shade perception and acuity. In very insufficient illumination there is failure to see contrast and detail, and there is an instinctive effort to push the eye near to the object, at the risk of seriously straining the mechanism of accommodation.

Dr. Bell discusses the phenomenon of irradiation, using the incandescent lamp filament as an example. He then goes on to the matter of steadiness of illumination. Violent transitions of light and darkness are distressing and injurious; but the retina has a certain amount of visual inertia which furnishes protection against very rapid changes. Flicker, from a practical standpoint, is troublesome about in direct proportion to its magnitude, and in inverse proportion to its frequency. The author, in stating that artificial light should never be arranged so as to cause sudden transitions for the eye from bright to black surfaces, draws attention to some most "horrible examples" of desks brilliantly illuminated by shaded lamps and surrounded by other articles in the room on which no light at all falls. Reference is made to the objectionable reflective character of some paper surfaces, the indirect light from which may cause a great deal of harm to those who, like book-keepers, have to work with them. The direction of illumination should be such as to free the eye from the effect of wavering shadows of the hand or head. Hence the *rationale* of the sound old rule that the light should come from the left.

Coming to the question of colour, Dr. Bell says that strong colours are common, and are likely to be increasingly so, since selective radiation is necessary to high luminous efficiency. Reference is made to the fact that one has in illumination to deal with the yellow of the flaming arc, the yellowish green of the Welsbach, the blue green of the mercury tube, and the violet of the enclosed arc, all of which may have to be compared with the deep orange of the Hefner lamp. Practically the question of suitable colour resolves itself into two parts—first of all the effect of colour on the proper functioning of the visual apparatus, and, second, its relation to our observation of coloured objects. The author does not fully discuss the theories of colour vision, but has something to say as to the retinal rods and cones which are charged with many of the difficulties of colour perception. He sums up this part of the paper by stating that rod vision seems to be predominant from the very threshold of illumination right up to several tenths of a metre-candle and to continue in force to all ordinary intensities, although rather easily exhausted. It gives low visual acuity and shade perception perhaps of the order of a tenth normal; but, such as it is, it is our main nocturnal reliance. Cone vision begins to come perceptibly into play at a few thousandths of a metre-candle, and at a few tenths is pretty well established; but it is remarked that it does not become normal over the visual area below five or ten metre-candles, and gains materially even beyond this, especially in acuity, which is weak at lower intensities.

Dr. Bell speaks of the necessary adjustment of the focus of the eye in dealing with different colours at varying distances. He draws attention to an inherent danger in using monochromatic or strongly-coloured light for general purposes. Whatever may be the nature of colour vision, a strongly-coloured light utilizes only part of the visual apparatus. If of high intensity to make up for inherently low luminosity, it rapidly exhausts that part, and produces, as is well-known, a temporary colour blindness. There is at least a serious chance that long continued use of coloured light would produce persistent and perhaps permanent damage to colour perception. A light nearly white, with its maximum luminosity near the normal wave length, runs the least chance of imposing abnormal strains on the visual apparatus.

In concluding, Dr. Bell mentions an interesting question which arises with reference to obtaining a light of high efficiency by building it up from the monochromatic primary components—that is to say, as to whether the eye would see clearly by such a light and discriminate colours properly; and to this he says that the answer is probably in the affirmative. As yet, however, no means are available for producing all three primary colours efficiently, and for white artificial light we are compelled to rely on what is in effect building up a nearly continuous spectrum from heterogeneous components, unless, as usual, we employ the continuous spectrum of an incandescent solid.

* The author speaks throughout in metre-candles instead of foot-candles.

Bordeaux in Darkness.—According to a Reuter telegram sent from Bordeaux last Friday, the city was in darkness at night owing to a strike of gas and electric light employees. A telegram dispatched on Saturday, however, was to the effect that, as the result of the signature of an agreement putting an end to the strike, the gas workers resumed work that evening.

THE DEPARTMENT OF GAS ENGINEERING, FUEL, AND METALLURGY AT THE UNIVERSITY OF LEEDS.

THE newly-founded Department of Gas Engineering, Fuel, and Metallurgy at the University of Leeds, to which reference has been made in these columns on several occasions lately, is part of the large scheme of extension and development undertaken on the elevation into an independent University of what was formerly merely one of the three Colleges constituting the Victoria University. By a happily chosen arrangement, this department shares a complete and independent building with the mining department. Even a cursory inspection of the buildings and equipment shows plainly how much this conduces to the advantage of each department and the students of each, while there is a kind of sentimental fitness in this association of two great industries—coal getting and coal using; for, as Professor Thompson reminded members of the Yorkshire Junior Association at their recent visit, whatever kind of gas is made, and whatever materials are used (coal, coke, or oil), dependence must ultimately rest upon the miner for the supply of the raw material.

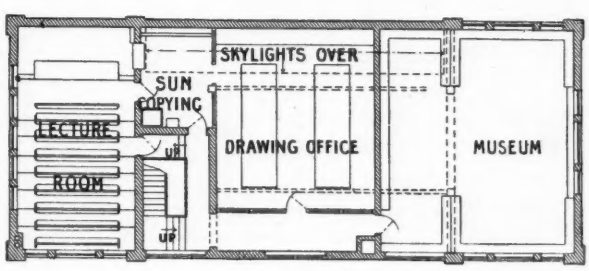
Still another suggestive illustration of this dependence of the one industry upon the other is presented by the fact that the Gas Engineering Department is, with the Mining Department, housed in a building erected and equipped mainly from a fund of some £8000 raised by the Yorkshire coalowners (largely by the exertions of the late Mr. Alderman A. Currer Briggs, J.P., then Lord Mayor of Leeds and Chairman of the Advisory Committee of the University Mining Department. Thus, though the gas industry is now extending much-appreciated help in the shape of the endowment fund recently inaugurated by Sir George Livesey (see "JOURNAL," Vol. XCIX., p. 681), and the two researches established by the Institution of Gas Engineers, still, for the original capital expense of the magnificent new advantages offered to it, the industry is mainly indebted to its friends and allies, the coalowners.

It had been intended to incorporate a description of the new buildings and their contents with the report of the proceedings of the Yorkshire Junior Gas Association at their recent annual meeting, when the members were shown round the new department; but, by Professor Bone's desire, it was postponed till more progress had been made in getting apparatus, &c., into position and working order. The new building stands by itself near the main University Buildings, and is a three-storied rectangular structure designed by Mr. Paul Waterhouse. As it does not front the open road, no special play of architectural fancy has been bestowed upon its exterior; but any sense of disappointment which the outside may arouse at once subsides as the interior reveals the ingenuity and forethought embodied in the arrangement and fittings, and as the completeness of this equipment is realized.

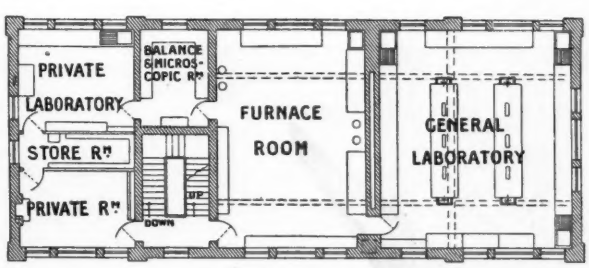
The chief part of the domain of the Department of Fuel and Metallurgy is on the first floor, where there is: (1) A large furnace room; (2) the general laboratory, more especially for gas and fuel investigations; (3) a balance and galvanometer room; and (4) the Professor's private room, stores, and laboratory. In addition, it has, on the ground floor, (1) general stores, (2) workshops, and (3) a photometric and lamp room; while on the top floor it joins in the provision of a lecture room and a museum. The whole building impresses one with a sense of spaciousness and airiness. It is bright in appearance, and flooded with natural light; and when that fails, electric lights can be turned on in all parts of the rooms—no small ingenuity being manifested in the provision of these in any place where their assistance may be needed at some time or other. Fear of fire is reduced to an absolute minimum. Very little inflammable material has been used in construction and fittings, and the floors and staircase are of concrete. The note of lightness and brightness is struck as soon as the outer doors are opened. The walls of the small entrance hall and the staircase are all of smooth buff brick, with a dado of glazed dark brown bricks; while a similar arrangement is found in most of the rooms. Painted or plastered walls are almost entirely absent. In the general laboratory, glazed white bricks have been very effectively used in the lower part of the walls, shelves, &c.

In a prominent place on the staircase is a medallion of Henry Cort, 1740-1800, "to whom the world is indebted for the arts of refining iron by puddling with mineral coal and of rolling metals in grooved rolls." Such recognition of the work of great pioneers is always graceful, and is very fitting in a modern University. One often wonders why more use is not made of the stimulus afforded by constantly seeing the portraits of such men. The features of the great men, both in pure science and in industrial developments, are with few exceptions unknown to most of us, however much honour we pay to their memories. On the bare walls of staircases and lecture-rooms such portraits might well be hung; and in any case a beginning should be made in the present instance with a companion medallion of Murdoch. Perhaps Mr. Charles Hunt, who has made so many investigations into the earlier incidents of gas making and gas lighting, and whose interest in the relics and mementoes of that period is so well known, might feel disposed to take the matter up. In passing, it may be said that Leeds has not been unmindful of its famous men, and that, among the statues of the Leeds celebrities that adorn the City Square is one of Joseph Priestley, the discoverer of oxygen, &c., whose balance and other pieces of apparatus are among the treasures of the University.

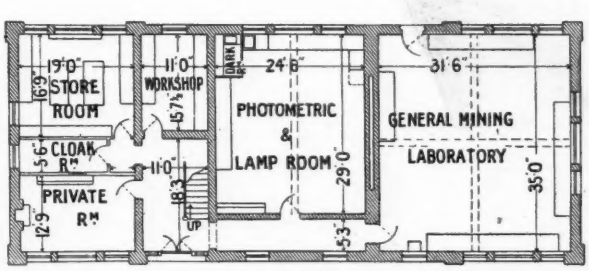
Taking, now, the rooms in order and in detail, we may begin with the furnace-room. Students here will be able to amplify the general work they have taken in the Engineering Department, will make a practical study of the characteristics of the metals used in constructional work, and will extend that study to alloys of various composition that they themselves have made. The whole length of the room along one side is devoted to furnaces, standing on stone slabs supported by brick piers, or standing on the concrete floor. Included in the equipment is a full range of the various sizes of gas crucible furnaces, oil cyclone furnaces, in which a very high temperature can be reached by the combined use of oil flames and a powerful blast, a gas reverberatory furnace, capable of adjustment so that the charge is being heated in a reducing or an oxidizing atmosphere, gas-heated muffle, sagger and retort furnaces, some on the regenerator system. The blast for these furnaces is supplied by an electrically-driven Crowell blower placed on the floor just in front; and all furnace work is done under spacious hoods, with a mechanically produced draught sufficient to draw off all products of combustion. This not only keeps the laboratories sweet, cool, and fit for delicate work needing an equable temperature, but conserves the safety and health of those using the furnaces. Here, as elsewhere, all blast, gas, and water pipes, and all electrical connections, are placed on the outside of the walls, and immediately accessible. Electrically-heated tube and retort furnaces are also installed in this part.



Second Floor Plan.



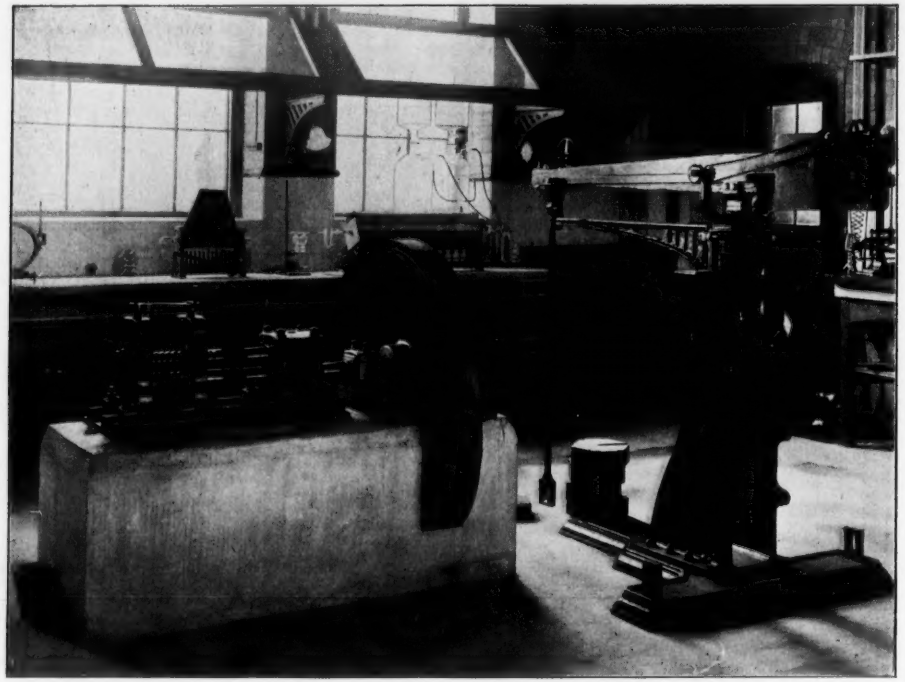
First Floor Plan.



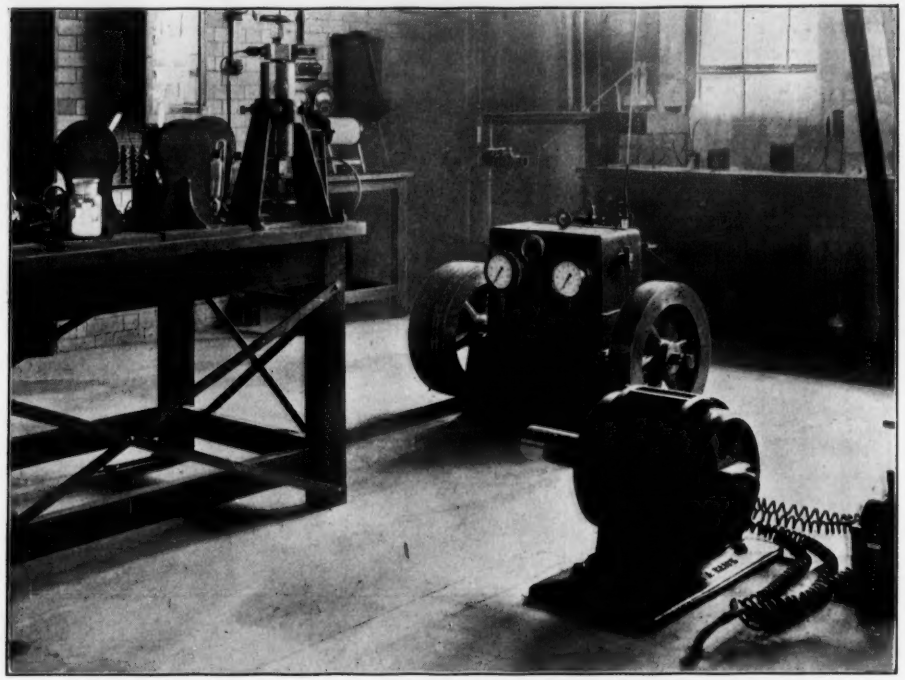
Ground Floor Plan.

Leeds University New Building for Mining, Fuel, and Metallurgy.

Half the middle floor space of this room is occupied with the machines for testing the mechanical properties of metals and alloys. First is an experimental rolling mill capable of reducing ½-inch rods to ¼-inch section, and is interesting as being the first of the kind installed in any educational institution in the country. From this a student can take his reduced rod to a tensile-testing machine and find its breaking strain, &c. A corresponding torsion-testing machine has been installed; while near is an ingenious machine for comparing the behaviour of rods of different metals under the combined influences of impact and alternating stresses. Along part of the wall opposite the furnace equipment is a range of electrically-driven machines for pounding in agate mortars, for cutting sections of metal rods, grinding



Furnace-Room, Showing the Experimental Rolling Mill and the Denison Testing-Machine.



Furnace-Room, Showing the Gas Compressor and the 11 Feet Gasholder.

and polishing them, and thus preparing them for microscopic examination and photography.

On the adjoining floor space is a table of massive apparatus, designed for carrying out research work on gaseous explosions under high-pressure, and includes the compression mechanism, as well as storage cylinders and explosion vessel. Professor Bone has already laid memoirs on the subject of combustion before the Chemical Society, and looks forward with keen interest to the results of future work with this apparatus, which, it is hoped, will throw much needed light on the chemical aspect of gas-engine problems.

Near by stands a compressing plant of larger size, in which gases can be compressed up to 200 atmospheres. Nominally some 30 feet of gas can be thus dealt with in an hour; but in actual practice it has been found capable of compressing 11 feet of hydrogen to 200 atmospheres in ten minutes. The compression is accomplished in two stages—first to 10 atmospheres, and then to the final degree—both cylinders being immersed in water so as to carry off the heat developed during the operation. Along the west side of the room is a bench fitted for the preparation, purification, and storage of gases for various experiments, a large test-holder of 11 cubic feet capacity standing in the corner and forming the store from which the main compressing plant draws its supply of gas. As an adjunct to these pieces of apparatus, research students will also have the use of the plant for making liquid air, &c., now being erected in the Chemical Department. The bench along the east end of the room is intended for the ultimate analysis of coal, steel, &c.—all the furnaces being under glass hoods, so as to facilitate the removal of the products of gaseous combustion without interfering with the lighting of the room.

On the wall in a far corner is a somewhat inconspicuous pyrometrical arrangement, which, when explained, proves to be of exceptional interest, and opens up very long vistas of future possibilities. In fact, it indicates as forcibly as anything in the building how the very highest developments and the most minute accuracy of modern instrument making has been pressed into the service of the new department. The ascertaining of high temperatures with as much accuracy as has been rendered possible is of most vital importance to the work, especially the research work, done here. Accordingly, here and in the adjoining balance room is a complete installation of the best recording electrical and optical pyrometers. In order to facilitate the use of these pyrometers, eight circuits have been fitted in various parts of the laboratories, and any of these can be joined up to the pyrometers. By an ingenious piece of foresight, connections of all kinds can be made between all parts of the various rooms without breaking through walls. Specially moulded bricks, with several openings through each sufficiently wide to take any necessary pipes or wires, have been inserted at intervals in the dividing walls near the ceilings. The first of these pyrometers—the Callendar Recorder—is based on the variation of the resistance of a platinum wire with variations in its temperature; the temperature being recorded by an automatic arrangement on a Wheatstone bridge wire, the position of equilibrium indicating the temperature. The instrument can be made to record a range of 50°, 100°, or 250° C.; and by inserting different bridge wires this record can be made to start from any given hundred degrees, and register temperatures up to 1100° C. The recording gear can also be varied so that the record shall extend over 25 hours or 2·5 hours. A Roberts-Austen arrangement of the Le Chatelier thermo-electrical pyrometer, with a photographic recorder, is placed in the next room; the intention being that the one system shall be employed as a check upon the other.

On a small table below the first recording pyrometer is an apparatus for determining the cooling curves of steel and other alloys. This is a duplicate of the standard instrument used in

Furnace-Room, Showing a Group of Gas Crucible and Muffle Furnaces.

General Laboratory, Showing Apparatus for the Study of Catalytic Gas-Reactions, &c.

the research conducted at the National Physical Laboratory by Dr. H. C. H. Carpenter, under the auspices of the Alloys Research Committee of the Institution of Mechanical Engineers. Included in the pyrometrical equipment is a Féry absorption pyrometer, which is based upon optical comparisons, and is a very handy means of approximately ascertaining high temperatures (say) between 1000° and 3000° C. The balances in this room are of various kinds and of varying delicacy—all being of the most up-to-date type, and the electric lamps travelling along horizontal wires just over the balances, and so shaded as to throw light only downwards through the balance case, are an obvious convenience, which a foggy day helped to emphasize.

Alongside the furnace-room is the general laboratory, amply lighted by means of windows along three of its sides. The working benches fill the middle of the room. These make a generous provision of working space for each student; and their surfaces are unbroken by shelves or water-sinks. The few reagent bottles allotted to each student stand on tiles let into the middle of the bench top. Sinks are provided at the end of the benches, and large ones at the corners of the laboratory; and water-channels, for condenser water, &c., run into these along the backs of the benches which stand against the walls. Each student's bench is plentifully provided with cupboards, and has gas, water, air-suction, and electrical attachments, and adjustable overhead electric lights. A slate-topped bench running the full length of the north wall is designed for work needing electric current; a 100-volt direct current, a 240-volt alternating current, and a 16-20-volt current from eight large secondary cells are here available at each working place.

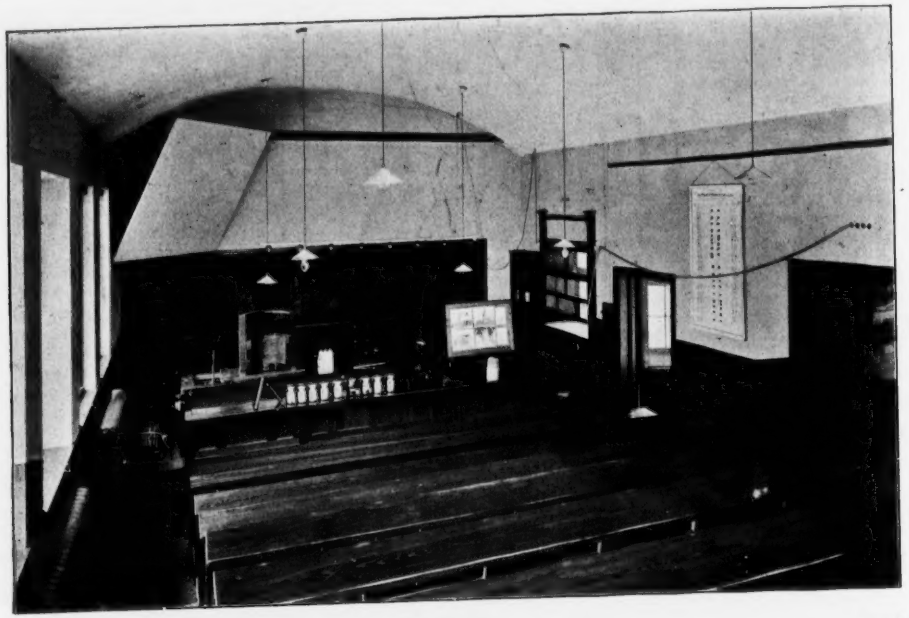
The opposite side of the laboratory is partly occupied by two sets of special apparatus for research work on gaseous combustion and catalytic gas reactions. These are elaborate arrangements of glass tubes, bulbs, and taps permanently fitted together, and constitute a fine example of the glass-blower's art. They embody one feature of Professor Bone's general policy for the work of his department—viz., that, as far as practicable, the research equipment shall be of a permanent nature, and when an investigation has been brought to a successful issue, exercises with the original apparatus, on the essential lines of the research, shall be embodied in the general course of practical work. The students will thus be initiated into research methods and equipment before they enter upon any original investigation for themselves.

The bench along the west end of the laboratory is reserved for calorimetry and gas analysis. Chief among the calorimeters are the Boys' gas-calorimeter and the Berthelot-Mahler bomb-calorimeter; while gas analysis is chiefly represented by apparatus for refined working as distinguished from the commercial methods which would be employed on works. Chief among these is Professor Bone's own research apparatus (a modification of the well-known Frankland instrument), which is erected in his private laboratory. A somewhat smaller form of the apparatus, suitable for commercial analysis, is placed in the students' laboratory.* The remaining side of the laboratory is taken up by three large and well-lighted draught-chambers with the usual gas and water connections.

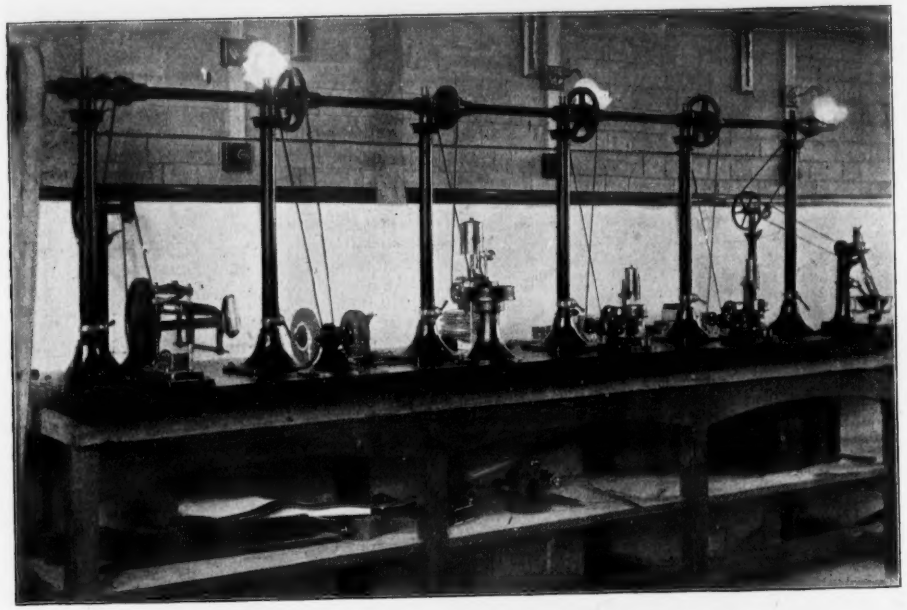
The remainder of the first floor of the building is devoted to the Professor's private room, stores, and laboratory. In the former is erected the latest form of the well-known Zeiss' installation for the examination of the micro-structure of metals, including a powerful electric lantern for projection and photographic work.

The lecture-room and the museum on the top floor call for no

* This was described by Professor Bone, in a communication to the Yorkshire Section of the Society of Chemical Industry, held yesterday week, the 9th inst.



Lecture Room.



Grinding and Polishing Machines in the Furnace-Room.

special comment, especially as the "gas" section of the latter will gradually be accumulated. On the ground floor is the general stores-room; a workshop for the mechanic attached to the Mining and Fuel Departments, fitted with wood and metal working machinery; and a photometer room. This latter will eventually also house the lamp-testing equipment of the Mining Department. The photometric apparatus occupies one side, and consists of a 12-foot photometric bed quite unenclosed, fitted with a Harcourt 10-candle pentane standard lamp, bunsen disc, flicker photometer, &c.; so that it can be used for any photometric test, and will lend itself to new arrangements and modifications of tests. Before this stands a 5 cubic feet gasholder with its connections; so that tests can be made on any gas, and in the case of mixtures of gases, like ordinary town gas, such a store can be kept as to allow of a series of tests on a uniform mixture. Tests under varied pressures can also be easily arranged.

The accessory arrangements are notable, and might with considerable advantage be copied on many gas-works. Disturbing draughts and the sudden inrush of light from a door unexpectedly opened are avoided by heavy curtains, which can be drawn completely round the apparatus at a convenient distance behind the operator. As they stop short a good way below the ceiling, and as the photometer itself is quite open, there is thus no fear during long-continued tests of conditions being modified, and results vitiated, by a notable increase in the temperature all round the lights being used. As the room is a very large one, and as its warming and mechanical ventilation are well under control, constant and suitable conditions are secured. The windows (on one side only) get their light through the ore-dressing shed, and are provided with efficient dark blinds; and to prevent the disturbing influence of reflected light, the whole ceiling is painted a dead-black, as also are the walls, &c., adjoining the photometer. Immediately adjacent is a photographic dark room, and a bench with water-fittings, on which calorimetric tests can be carried out and done simultaneously with the photometric tests.

The notable advantages accruing to the Gas Department and gas students from being in the same building as the Mining Department is strikingly evidenced here. The remainder of the room will soon be occupied by a unique set of arrangements for studying the action on flames of air containing various proportions of inflammable gases. In a specially designed dark room, the characteristics and behaviour of the faintly luminous cones indicating the presence of inflammable vapours can conveniently be watched. Galleries will be erected for testing safety lamps in vertical, in horizontal, and in oblique explosive currents. Air blast and gas at constant pressures will be laid on, so that a continuous current of air with a fixed percentage of an inflammable constituent can also be obtained. A steadily increasing inflammability can be produced; and thus the phenomena accompanying the gradual development of dangerous conditions in a mine can be observed safely and at leisure. Another gallery will be for testing lamps in explosive currents of high velocity. Chambers will be provided for testing lamps under conditions analogous to those existing in mines when blown-out shots occur, and one large enough to admit of continuous testing in a uniform atmosphere—that is, with the products of combustion being diluted and carried away as fast as produced.

When, in addition to these, mention is made of a machine for testing anemometers, and galleries for illustrating ventilation and working out its problems, enough has been said to show how usefully all this might be employed in the instruction not only of regular University students of gas engineering, but of many actually employed on gas-works or in distribution work, who would be glad of the privilege enjoyed by many mine deputies, sub-managers, &c., in attending special courses in such subjects. As Professor Thompson puts it: "These men can't have a mine made explosive for their special benefit; but we can so closely reproduce the same conditions that they will be quick to perceive and understand all the explosive conditions when they do arise in the mine." The Mining Department is one of the few University departments which do thus regularly get a number of occasional students direct from the works—a fitting return to make for the privilege of instructing its students at mines in the neighbourhood, not only in underground surveying and in the connection of underground and surface surveys, but also in general mining work.

The next few years will be critical ones, both for the new department and for the gas industry at large. The former is now definitely introduced to the profession, is being officially recognized and assisted by it, and its work will be watched with close interest. On the other hand, the offer of these advantages serves

as a touchstone by which the gas industry will be tested; and on the results of that silent almost unnoticed test large issues will depend. The extension of University training to the industries is comparatively a modern development, and its early applications were modest and somewhat tentative. When first it was suggested to deal with Civil and Mechanical Engineering at the Universities, the proposal received much good-humoured ridicule. Still, the new methods received a fair trial, which resulted in general acceptance of the newly-offered facilities. The success of the first University Department of Engineering led to other Universities following in the same path, till now Engineering is well represented in our modern Universities. Consequently engineering—civil, mechanical, and electrical—is provided with not a few men of the highest scientific and technical attainments; and it is to the outcome of their work that much of the keenness of the future competition of electricity with gas will be due. Such men are not the only important factors in the fight; but they may often be the factors that determine the issue. This is brought strikingly to mind when one remembers that two of the most powerful weapons in the hands of the gas industry to-day are the outcome of the work of University men—viz., the atmospheric burner of Professor Bunsen, and the incandescent mantle of Auer von Welsbach.

At the beginning of the second century of its history, the Gas Engineering profession has the initial offer of similar University advantages to those enjoyed by the rival profession. If it embraces its opportunity, and if Leeds is supplied the next few years with a band of earnest enthusiastic students all will be well; but it must be clearly remembered that more important than any interest, recognition, or even monetary assistance is this supply of students. A crowd cannot be expected; but it is to be anticipated that throughout the ranks of the profession there will be found sufficient men of such faith in the new venture, and of such perception of the needs and conditions of the future, that, from their own sons and relatives and from those introduced to them as would-be entrants into the upper ranks of the profession, the needed supply of suitable students can be ensured. It should not be forgotten that the Government devotes a fund of £100,000 annually in aid of University work. To this fund the gas industry has contributed in the shape of income-tax paid on its profits; and therefore, on the lowest grounds of self-interest, it should take care to duly participate in the benefits of modern University developments.

The aims of the new department were concisely summed up in Professor Bone's words to the members of the Yorkshire Junior Gas Association on their recent visit (*ante* p. 254): "The functions of this new department are: (1) By its teaching to impart sound knowledge; (2) by its scientific research continually to sift that knowledge, so as to distinguish between what is sound and unsound in theory; (3) by its close association with the industry at its doors to help those responsible for the conduct of practical affairs so to apply the sound in theory that it may be most fruitful in practice; and (4) so to combine its teaching, research, and industrial connections that its students shall be trained in an environment of ceaseless mental activity and strenuous practical effort." Teaching, research, and industrial connections are its essential features. No one, especially in University circles, imagines that a University technical department turns out the finished article, or that its graduates will straightway proceed to take the responsible places in their profession, to unravel its mysteries and solve its perplexities. The work in such a department can only serve as a preparation, and in no sense as a substitute for experience and training on a works. Partly for this reason no attempt has been made to set up an experimental gas-works, or to work on a large scale. Much, though by no means all, of the special teaching here will deal with general principles; while, as the equipment indicates, the actual practical work—both routine and research work—will mainly deal with fundamental problems.

Ahead of the general students will be advancing a body of investigators, again dealing mainly with fundamental problems rather than with industrial conditions. As has been previously mentioned, their apparatus will finally form part of the permanent equipment of the laboratories, and succeeding students will embody researches in the regular routine course, and so definitely settle on and possess the newly opened-up territory. Then, having sent out into the gas industry men thus equipped and thus trained, there will gradually develop the third, and possibly the most important, feature of the work as these men get grip of the actual working conditions. Then will come the time and the best opportunity for the investigation of the more recondite problems of gas manufacture and utilization. With such trained investigators, or at least picked men from among them, attacking large-scale problems under actual working conditions—reinforced if necessary by others dealing independently with the same matters, and all in touch with one another through Professor Bone, who will assist in mapping out the attack, reconnoitring the positions, and examining the ground won—we may confidently hope to see notable victories achieved. Professor Bone is already co-operating with some of his former students in technical researches, under works condition, on problems not unconnected with gas manufacture; so that this development of his work is not wholly a dream of the future. The contemplation of what may result from the developments of science as applied to the gas industry makes one join with Professor Bone in "hoping that the day is not distant when the University will form the normal and rational avenue to all the higher ranks of professional and industrial service."

WAGE-EARNER OR PARTNER.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The paper read by Sir George Livesey at the recent meeting of the Southern District Association of Gas Engineers was limited to one aspect only of what is in reality a large and far-reaching social question, which only those who have had working experience, are in a position to discuss. It must be admitted that the author upheld his proposition that the co-partnership scheme was financially a success; but even if this advantage could not be claimed, there are other considerations that should appeal strongly to the higher feelings of the parties actually responsible for determining the conditions of work and wages. The relationship between the board-room, the office, and the workshops, in the partnership companies is evidently all that can be desired; and the heartiest advocates of the scheme are those who have had the longest experience of it. Yet a student of the general question might well ask why a policy, admitted to be successful, finds so few followers, and why the majority are satisfied to stand as admirers at a far distance.

Perhaps the chief reason for this rather inconsistent position is the absence of any special need for changing, or, as some would put it, for upsetting the existing arrangements relating to work and wages. Sir George Livesey's scheme was launched under strong pressure of circumstances, which rendered some new departure little less than a necessity; and it is only in human nature to shelve the question until the need for a solution becomes acute. The stress of competition and modern business methods increase the need for a better and more efficient order of service; and the spread of education has led workers of all kinds to look for some degree of comfort, not to say luxury, in their habits of life. The living wage means considerably more than the term literally implies. A lot is written and said from time to time about the relationship—or, should we say, the antagonism—between Capital and Labour; and every now and again we hear of a great industrial war. But as a matter of fact the parties concerned in such disputes, however large in point of numbers, are a very small percentage of the whole body of employers and workers. In nine cases out of ten—and gas-works will usually be found among the nine—the antagonism is more a matter of theory than of actual fact. It bulks largely on paper, and when likely to be of any utility as a party cry, on the political platform; and we are accustomed to see Capital represented by a portly figure carrying obvious signs of overfeeding and an excessive display of jewellery, and Labour as a mere bundle of leanness and rags, but regard the same as a caricature rather than a presentment of fact. This may not be the genuine Old Kent Road article; but the theoretical antagonism is amenable to good sense and good feeling on both sides, admitting of a counterfeit sufficiently good to pass muster as the genuine thing, and leaving no special inducement for change, in the average gas-works.

In theory the wage-earner and the partner are ranged on opposite sides of the camp; but in practice there is no sharp line of demarcation. The majority of the members of the Southern Association who assembled in such goodly numbers to hear what Sir George Livesey had to say about the scheme with which his name will always be honourably associated, partake more of the character of partners than of wage-earners, in regard to the way in which they carry out the duties incidental to their positions, although they have not a direct interest in the profits. As much may be said of the heads of the office staff, and the foremen over the several departments, and, to a greater or less extent, the same holds good in respect to any responsible official. But the lower we go down the working scale, the nearer we seem to get to the wage-earner of theory, who is supposed to think only of himself, or shall we put the matter more generously, and say of his class? His main object is not to do too much; and with regard to the materials, tools, or appliances provided for his use, it is not "his business" to avoid waste, and he is rather inclined to favour reckless usage or an unnecessary smash now and then, not out of any ill-feeling to his employer, but because it helps to "make work," which to his idea is the sole reason for the existence of employers as a body. Some might even object to the term earner, and say that he seeks to get rather than to earn. The partner not only fulfils his daily round, but, in addition, has an eye to the interests of his employers—*i.e.*, himself and company—in every possible way. He studies how to prevent waste of materials, or undue wear of tools. And while the wage-earner is only concerned with the action of his associates so far as they affect his own comfort or interests, the partner not only avoids abuses himself, but will have something to say about any that may come to his knowledge in connection with others.

In practice, the thing works out differently. Beginning with the lowest order of wage-earner, he usually prides himself on being independent of any favour, and as giving a full return for his remuneration. One of the most effective ways of offending the working man is to say that he is not worth his money. It is is not an unusual thing for the wage-earner to take an interest in, by identifying himself with, the business of his employers; and very few would be willing to see the firm suffer injury or loss if a movement on their part would prevent it. It may at once be said that if views of this nature did not permeate throughout the larger part of the staff, it would be simply impracticable to run a gas-works or any similar industry. The chief, and the heads of

departments at least, must be imbued with some of the attributes of a partner.

The primary object of all industrial workers is self-interest; and the crudest method of securing better service is to offer better pay. A capable and conscientious worker can be encouraged and stimulated to further effort by judicious consideration at the pay desk, and a whip can also be applied to the laggard by the knowledge that increase of pay also increases the number of those who are open to take the job. By offering the full average wage in the district, and perhaps a little more, there is rarely any difficulty in getting the full complement of hands. Another thing that will be appreciated by the respectable worker is a permanent job. He knows that if the work at the gas-works is heavy or dirty, there is the prospect of a full week's wage throughout the year. In addition to the "pay," there is what may be called for the sake of distinction "the bounty," which may consist of a good conduct allowance, of free holidays, of the various forms of payment by results, or by piecework; the essence of the latter system being that it allows the worker to appreciably increase the day-work earnings.

With regard to these methods of increased pay, there is always a fly in the ointment. A bonus on the increased make per ton of coal above a given standard may rouse an undesirable degree of interest in the water-line of the station meter. There are also other motives that tend to secure good service, apart from the question of remuneration, such as natural aptitude, a sense of duty, or a desire to avoid dismissal. The manager of a gas-works receives, or should receive, a salary sufficient to encourage him to use his best efforts. Even if dissatisfied on the score of remuneration, he may be disinclined to leave the town, or feel that he could not do better elsewhere, and that if he does not keep up a good showing he may be displaced in favour of another whose credentials give prospect of more satisfactory results. Much has been said lately about the importance of securing the good will of the customer, by good service, moderate prices, and so on. But it has not been sufficiently appreciated that the longest step in this direction is to secure the good will of the staff. The best resources of the concern are not likely to be developed by men, however conscientious, who know that their wages are kept rigorously at the lowest point of the labour barometer. If a superior article in clothing, food, or other necessary is wanted, we must be prepared to pay the price, and the same holds good in regard to labour, crude or cultivated. If a high class of services is required, a corresponding equivalent must be offered; and as long as this point is regulated by the hard and grinding laws of competition, there will be a tendency to run the quality of the service on the same lines.

All these considerations tell in favour of the partnership system. But we now come to what in most cases constitutes the chief difficulty, and it is necessity for weeding out. It is admitted that the scheme, introduced to what may be presumed was a fair average body of gas-works employees, was not a success when bestowed on all alike. This implies that certain ineligibles must go out, and that other more suitable workers will take their place. In passing, one cannot avoid a word of sympathy for some of the ineligibles. They are not all indolent, dishonest, given to beer, or otherwise objectionable, but may be physically or mentally incapable of taking up the quicker stride demanded. And this especially refers to men who are advanced in years. In small towns, at any rate, it will be found that some degree of responsibility for the rejected cannot be shelved. This will especially be the case in residential districts where manual employment is scarce. In addition to turning out the inferiors, there are the newcomers to replace them to be found. In large towns there may be a large surplus of unemployed labour to draw on, but in smaller towns there is not; and even if there were the numbers, there is no improvement in quality.

In a concern employing 100 hands there may be great difficulty, amounting to almost impracticability, weeding out 10 or 20 ineligibles, and of finding suitable men to take their places. Then it is evident that difficulties arise about the question of eligibility, which must be decided by the manager, with the board of directors or the chairman to act as a court of appeal. I would be the last to question the capabilities of the average board of directors; but are they competent to sit in judgment on the decision of their own manager in respect to such a question as the capabilities of an employee? It is the prerogative of the manager to decide working conditions; and the right of appeal to the board might be regarded as a reflection on his authority, and open up a way to frequent complaint and trouble. In practice, the board would hesitate before opposing the manager's decision, knowing that divided counsels do not tend to smooth working; and, in any case, in order to deal competently with such questions, the chairman or some member of the board should possess a professional status and position of a higher plane than that occupied by the manager. If the manager had found it necessary to give a negative vote in the case of one or more employees, and his decision was reversed on appeal, a source of opposition would be created that would not tend to improve the position.

So far as the manager and the chief officers are concerned, it is but a short step from the present position of wage-earner to that of partner; but when we get down to the average rank and file—the stokers, yardmen, labourers, service-layers and gasfitters, lamplighters, &c.—it appears that the transition is much too great to be capable of accomplishment at one stroke. There must be a great amount of preparatory and educational work. One of the parties or classes concerned cannot of themselves ensure success, which can only be attained by the combined efforts of all. The board and the management may be agreed as to its desirability; but there must be an equal determination to carry out the mutual character of the scheme on the part of all. The wage-earner must be taught how to efficiently earn his bonus; and, when he has got it, how to properly appropriate it. Unless both these conditions are observed, success is out of the question. To take an instance, many of the Army or Navy reserve receive a quarterly allowance, and some of them simply squander the money in drink. I have known men, well disposed, but weak, who have simply been ruined by the quarterly allowance. I have seen friends of well-known habits awaiting and hanging on to the recipient when he goes to draw his money, and I know that they are not doing so for the purpose of inculcating sobriety and thrift. And if it was known that a bonus of any kind was payable at the gas-works, the same gentry would be in active attendance. A lad at boarding school, who is the lucky recipient of a large cake from home does not lack "friends" so long as the cake lasts; and many working men will experience the same thing. The average worker would need to be instructed from the A.B.C., on the question of partnership and thrift. The worker is not likely to refuse anything in the form of direct or indirect increase of pay; but to make a satisfactory partner, he must not only have a clear grasp of the whole question, but be so far convinced of its advantages as to have a keen desire for it.

How is it possible to create a desire for the partnership, and the willingness to accept its obligations as well as its advantages? It amounts to increased remuneration in return for which an equivalent increase in efficiency is required. One method of introducing it might be to begin at the top with the manager and chief officers, and to let the thing gradually filter down. There is a tendency to undervalue that which is secured without trouble, and the partnership scheme might be more valued if it was used as a reward for regular conduct, or preceded by a reasonable period of probation.

SOCIETY OF ENGINEERS.

The Fifty-Third Annual General Meeting of the Society was held at the offices, Victoria Street, Westminster, on Monday last week. In the absence of the President (Mr. R. St. George Moore, M.Inst.C.E.), fulfilling a professional engagement in China, the Vice-President (Mr. J. W. Wilson) occupied the chair. The ballot for the Council and officers for the ensuing year resulted in the election of Mr. Wilson as Mr. Moore's successor, and of Messrs. G. A. Goodwin, E. J. Silcock, and Diogo A. Symons as Vice-Presidents. Among the Ordinary Members of Council are Messrs. John Aird, Samuel Cutler, jun., and W. Arthur Valon. Mr. David Butler Butler and Mr. Samuel Wood, F.C.A. (Messrs. Wood, Drew, and Co.), continue to fill the positions of Hon. Secretary and Treasurer and Hon. Auditor respectively. Among the awards announced by the Chairman for papers read last session was one of a Society's premium of books to Mr. C. A. St. George Moore, for his paper on "Working Experiences with Large Gas-Engines." A vote of thanks was accorded to the President, Council, and officers for 1907.

The annual dinner of the Society was held on Wednesday, at the Hotel Cecil—Mr. Wilson again occupying the chair. "The Society of Engineers" was proposed by Sir William Matthews, K.C.M.G., the President of the Institution of Civil Engineers. In acknowledging it, the Chairman referred in feeling terms to the loss the Society had sustained by the death of Mr. Perry F. Nursey, one of the oldest members, who had, he said, filled successively the positions of Secretary, President, and Hon. Secretary and Treasurer, and at the time of his death held the first-named post. He announced that the Council had appointed as Mr. Nursey's successor Mr. A. S. E. Ackerman, B.Sc. (Engineering), Assoc.M.Inst.C.E. Referring to the work of the session, he said they had had some successful papers and several interesting visits—a feature of their proceedings which the Society were the first to introduce, and which had been found of much value. He concluded by stating that the position of the Society was good, both numerically and financially, and asking for the support of the members at the meetings. The toast of "Kindred Institutions," proposed by Mr. John Kennedy, was acknowledged by Sir Alexander Binnie. During the proceedings, a selection of vocal music was given under the direction of Mr. Murray Rumsey.

Gas Analysis Apparatus for Commercial Purposes.—At a meeting of the Yorkshire Section of the Society of Chemical Industry held in the Fuel and Metallurgical Department of the University of Leeds on Monday of last week, Professor W. A. Bone, D.Sc., F.R.S., and Mr. Richard V. Wheeler, M.Sc., exhibited and described an accurate form of gas analysis apparatus for commercial purposes. The apparatus is an adaptation, in a convenient and not too costly form, of that employed by the authors in their researches on hydrocarbon combustion, and which has been used for upwards of 3000 analyses. It is specially adapted for the accurate analysis of coal gas, oil gas, water gas, &c.; and from long experience it can be recommended to all who desire a reliable instrument which is, at the same time, simple in design and rapid in action.

THE ILLUMINATING ENGINEER.

THE members of the Society of Engineers in Charge, at their meeting at the St. Bride's Institute, E.C., last Wednesday, were treated by Mr. Leon Gaster with an exposition of his views on the "Province of the Illuminating Engineer;" and at the conclusion of the paper, a full discussion ensued, which indicated that those present were by no means unanimous in their opinions as to the need for such a "new profession" as was referred to.

The paper was a lengthy one; and, of course, it contained much allusion to what has lately been accomplished in the United States in connection with the subject. The object with which it was written was to point out the means by which the existing state of affairs in the matter of securing proper illumination might be improved upon, and to indicate some of the important problems with which the Illuminating Engineer has to deal, and from the proper solution of which, it was urged, the consumer and the whole lighting industry would benefit in the future. The difference between light and illumination, said the author, might be defined—light was the cause, and illumination was the effect. An object on which light fell became illuminated; and an object was well illuminated when it could be easily seen without any fatigue or strain on the eyes. There was, however, the æsthetic aspect to be considered, with which the architect was very closely concerned, and which in many cases had not received the attention it deserved. The intentions of the architect were frequently defeated by the adoption of some tasteless and defective system of illumination, which quite failed to bring out to the best advantage the æsthetic and architectural features of a room or building. The enormous improvements made of recent years with different illuminants had rendered the proper application of the necessary principles somewhat taxing to the ordinary lighting contractor; and therefore much discussion had taken place with regard to the advisability of establishing a new specialist, to be called the Illuminating Engineer. It had been stated that the Illuminating Engineer would have to be a person of strong will and even temper, and would have to deal with gas, electricity, oil, acetylene, &c., and know how to make the best use of any or all of them. But even these qualifications did not constitute all that was required of him. He must possess a sound grounding in physics and chemistry, and some knowledge of physiological optics; he must be well up in the science and art of photometry; and, above all, he must have a lively sense of the artistic. He would have to be possessed of great tact and enormous persuasive powers, to wean people from such choice as an artistic but foolish fitting. In other words, the task of the Illuminating Engineer was not to be passed over lightly; and the numerous qualifications required would make it somewhat difficult to obtain satisfactory references if asked for.

The author remarked that the illumination of a room might be divided into two factors—that derived from the direct radiation from the source of light, and the diffused light resulting from the combined reflection from the surrounding surfaces, which varied very considerably; and he quoted the results of tests made by Dr. Louis Bell, of Boston, to determine the co-efficients of diffused reflection, obtained by using wall-papers of different finishes and various colours. These showed that the co-efficients for sky light varied from 0·56 in the cases of deep cream stripes and deep cream silvery stripes, to 0·05 in those of deep green *crêpe* and deep red *crêpe*. He also quoted tables by Mr. G. H. Stickney, of New York, showing the effect which certain coloured rays produced when falling upon different coloured objects, and the predominating colours of many artificial lights. After citing as one of the most curious instances of an "innocent misconception of the nature of reflected images" a patent granted about a hundred years ago for increasing the light of a gas-jet by placing round it a number of glass bottles filled with water, Mr. Gaster said the idea that light could be increased by reflection was one of the most persistent fallacies of the whole question; and devices were by no means unknown to the trade to-day which in reality were based on this principle. It might be put down as an established fact that all modern light sources were too bright to be used uncovered; and when the light was to be employed for careful vision—such as reading or writing—it should either be enclosed in some sort of globe which would produce a diffused light, or be placed so that the eye could not see the source of it. If this rule were adhered to, it would be found that none of the modern high-power lights were too hard on the eyes. The Holophane globes, he remarked, had been invented with a view to avoiding serious waste of light; being arranged to diffuse the light, and at the same time turn the rays into a useful direction.

The author then made a few remarks upon factory, shop window, and library lighting. Pointing out the false economy of requiring people to work by poor illumination, he said the personal inconvenience meant a reduction both in the quality and the quantity of the output—thus producing a loss to which, in comparison, the entire cost of illumination was trifling. The maintenance of the lighting system should not be left to the individual workman; the expense of the necessary lamps, to be regularly inspected, cleaned, and kept in order would be a mere trifle compared with the loss of time of the higher-paid labour of the operatives in keeping it in order, or the loss of efficiency in the same operatives due to neglect to properly maintain the system. As to shop window lighting, there was, perhaps, no other case in which light was so ineffectively squandered. Brilliant lights were frequently distributed either in the front of the window or among the contents of it, in such a way that the prospective customer could not gaze into the window without discomfort. Everyone had experienced the temporary blindness which followed an attempt to look steadily at an intensely bright object, and had noticed how impossible it was to see into a background behind a light of this description. This illumination seemed to have arisen through a confusion between two separate and distinct objects—first, to attract the attention of the purchaser; and, secondly, to exhibit the contents of the shop window to him when he had been attracted. If intense brilliancy was to serve as an attraction, the light should be arranged so as to be only visible to the destined customer, and not to obstruct his view of the window. Then with reference to libraries, the lights were often so placed as to brilliantly illuminate the gangway, while the lighting of the reading tables was less than insufficient. In a library, light should serve three chief purposes—it should enable the worker to read, it should illuminate the shelves of books so that the titles were easily recognizable, and it should illuminate the surroundings with a subdued, but sufficient, light. In improving these matters, the Illuminating Engineer could do much useful work.

The question of the proper placing of lamps, and the designing of entire illuminating schemes, might not, Mr. Gaster went on to say, be a very difficult task for those who had devoted attention to the subject; but when one bore in mind the fact that the requirements for proper illumination were not only concerned with efficiency as regarded current or gas consumption, but with the physiological and æsthetic effects produced, the problem became a little more complicated. In settling satisfactorily all these questions, the work of the Illuminating Engineer would be very valuable. It was not meant that he would be called in as a specialist for every little lighting installation; but his services would be important in assisting the architect and the consumer, not only in the selection of the proper type of lamp to be used, but in advising impartially as to the most suitable method of illumination to be adopted. In many cases gas and electricity were used side by side, each in its proper place, giving the consumer the best possible result under the circumstances. It was useless to deny that this new specialist, if he had made a thorough study of the different illuminants, and was not identified with any one of them, or connected with the sale of accessories applied thereto, would be a very welcome element, acting as a connecting-link between the architect, contractor, central station engineer, and consumer. The Illuminating Engineer ought to be responsible to the consumer for the ultimate result obtained in the scheme of illumination adopted at his recommendation. The consumer had a right to see that he obtained value for his money; and as illumination was an absolute necessity, the question under consideration was how to determine the correct quantity and quality required for different purposes. Who was to do this?

Touching upon another point, the author quoted a remark made by Mr. E. L. Elliott in the "Illuminating Engineer," to the effect that the purchasing and selling of light had from the beginning presented a curious anomaly of commerce. Its correlative money value had never been based upon a measurement of the thing itself, but upon the measurement of the commodity from which the light was produced. The two important steps, he said, intervening between the delivery of the illuminant and the production of illumination had been neglected. The whole question reduced itself to the one simple proposition, Can illumination be measured with sufficient accuracy, and with sufficiently simple apparatus, to make it a practical basis for money values? He believed that the present state of the science and art of illuminating justified an encouraging reply. The technical side of the question had been receiving a great deal of attention during the past year; and a number of new illuminometers had already been brought out, with a promise of others in the near future. Assuming that they had an instrument by which illumination could be measured at any given point, and on a plane in any position, what measurement should be taken as a basis of the payment for illumination? This was a matter which the Illuminating Engineers would have to decide. In 1892, Mr. A. P. Trotter, in a paper read before the Institution of Civil Engineers, said the study of light belonged to the science of optics, but very little information was available on matters of illumination; and he urged that when illumination was required, it ought to be possible to express intelligibly how much was wanted, and if a specification was given it ought to be known how to execute it. This suggestion had not before been put into general practice, not only because there were no satisfactory illuminometers manufactured, but because there were no authorities who could state definitely the amount of illumination required for different purposes. How would the data which were most essential for their guidance ever be obtained? Mr. Gaster's reply to his own question was: By securing a freer exchange of opinion and a friendly intercourse between the gas and the electric lighting engineers. In conclusion, he pointed out what had recently been done in America in the way of forming an Illuminating Engineering Society (which has already over a thousand members). A bureau, he said, composed of expert gas, electric, and oil lighting engineers, architects, physiologists, and opticians had been established in the States; and it was expected that the advice obtained from such a bureau of independent and impartial experts could only be of the greatest assistance in guiding them in the future towards betterment of

illumination, and towards beautifying their homes, public buildings, parks, and streets. That there was ample need of reform in the general practice of illumination, both professionals and laymen must agree.

In opening the discussion, Mr. A. P. Trotter (the Chairman for the evening) remarked that certainly Mr. Gaster was an enthusiast; and he had called attention to an extraordinary state of things in gas, electric, and other kinds of lighting. They did not want to know about lamps and candle power, but about the resulting illumination. There had been a very great lack of measurement. More than a quarter-of-a-century ago, Sir William Preece and he had turned their attention to the subject; and at that date Sir William had invented an illumination photometer. But this was too soon. Now, however, the question was coming forward again. It was important to treat the matter from a good common-sense point of view. It was very attractive to the mathematician; and they heard of mean spherical candle powers, and all that sort of thing. But in reality it was a simple problem, which seemed well worthy of the attention of almost all branches of engineering.

Mr. C. W. Hastings sympathized with what had been said as to the necessity of the Illuminating Engineer. There was great difficulty in getting a class of men who knew anything about illumination. It was only in the last four or five years that gentlemen had been brought to the front who could instruct the consumer as to the lighting of his premises. Recently rapid strides had been made in gas lighting; and now with the inverted burner it was possible to obtain as brilliant an illumination as with electricity at a very much lower cost. One who had taken a great interest in the subject was Mr. W. R. Herring, of Edinburgh, where the quantity of gas that the authorities allowed to be used in the lamps was for many years 2 cubic feet per hour for a flat-flame burner. For several years before the inverted burner came out, he tried to introduce the upright Welsbach; but he was not successful, because they tied him down to the quantity of gas named. But ultimately he introduced the inverted burner, and succeeded in getting an illumination of something like 30 candles per cubic foot with a consumption of 2½ cubic feet per hour, or a total of about 70 candles, as compared with the old flat-flame burner, which gave an illumination of 7 candles with a consumption of 2 cubic feet. He was not, however, there to defend gas, but to speak strongly of the necessity of establishing in this country an Illuminating Engineering Society. Gas men and electricians had their hands full turning out their commodity for others to use.

The next speaker, Mr. Wilson, also thought such an Association as was advocated most essential from a gas and electric lighting point of view; but he said the way the Society were going to work was quite another matter. In this respect he did not quite agree with Mr. Gaster, who claimed rather that a new branch of experts, called Illuminating Engineers, should be formed, Surely, at the present time the general consumer had quite sufficient experts. There were the consulting engineer, architect, quantity surveyor, sanitary inspector, and others, round him. If they were going to pile another percentage on to his bill, he might become sick of experts altogether. He rather favoured the idea that the gas and electric lighting people should turn themselves from gas and electric engineers into Illuminating Engineers. Let these men join hands with the manufacturers, form a society, and educate themselves, instead of another branch of experts being founded.

Agreement with these views was expressed by Mr. Cooper, who did not think the Illuminating Engineer would be welcomed by the architect. The average building would not stand the fee of the Illuminating Engineer. As to the founding of a new Society, he would ask Mr. Gaster to pause, as there were already so many that it was becoming impossible to attend the meetings of all. There was an Institution of Electrical Engineers; and he thought a Committee of this body could do excellent work in collecting data about illumination. Even if they were not unbiassed—well, he did not know that they would have unbiassed opinions at a meeting of a Society of Illuminating Engineers. His feeling was that it would be much better to utilize the Institution of Electrical Engineers and other bodies, and have a joint committee, if necessary.

Mr. F. W. Goodenough said that, to his mind, Mr. Gaster had proved the necessity for an increased study of the science of illumination, rather than the necessity for the expert Illuminating Engineer or even for the institution of another Society. As had already been remarked, there were a good many Societies already; and he did not think Mr. Gaster had proved his case for another one. He had undoubtedly proved his case for an increase of knowledge on the question of illumination; and possibly a journal devoted entirely to the subject might be of great interest to those who were responsible for the lighting of premises. Just who was responsible, was, of course, a question nowadays; but speaking from his own knowledge of the gas industry, it was a fact that the public were, in a very large and increasing measure, asking the suppliers of the illumination to also furnish them with information as to how the illumination could best be used and applied. The Gaslight and Coke Company found that the public looked to them for considerable assistance in this particular. They did not pay for it; and he did not think that they would be very willing—more especially the average householder or the small shopkeeper, for whom it was as important a matter that their illumination should be carried out on scientific lines as it was for large buildings—to pay an Illuminating Engineer. The shop-keeper or householder, after listening to the various arguments of the gas and electric light man, would make up his mind which he would use; and then he looked to the supplier of the illuminant to advise him as to which were the best types of lamps or burners to use, and how best they could be arranged in the premises to be lighted. His Company found an increasing call upon them for such advice. They had to employ experts who devoted themselves to practically nothing else but arranging installations for consumers; and they were at the present time holding continuous classes for the instruction in the art of illumination of the whole of the staff who had to deal with the public, because they believed it was right that they should be in a position to furnish information on this point. It was a great advantage to the makers of any illuminant—whether gas or electricity—to be as closely as possible in touch with the users of what was produced. It was quite right that the finest advertisement was that the goods supplied should be used to the best advantage; the wasteful burner or lamp was the worst enemy of the supplier of gas or electricity. The difficulty, of course, in regard to Illuminating Engineers would be to find thoroughly impartial as well as skilled men to take up the profession. It was almost impossible nowadays to find anyone who was not biassed one way or the other, or not prejudiced, in the matter of gas or electric light. In his opinion, the suppliers of the illuminants were the people to furnish the advice required. In the United States, where the Illuminating Engineering Society had flourished to such an extent, it should be pointed out that in a large number of cases, gas and electricity were supplied by the same authorities.

Speaking as an electrical engineer, Mr. J. Harrington remarked that another expert on the job would simply mean an extra percentage to be added to the bill. He thought both gas and electrical engineers were really Illuminating Engineers; they did the best they could with their respective commodities. Mr. C. Le Maistre pointed out that at present electricians were somewhat hampered by restrictions in the 1882 Act; and he hoped when an Illuminating Engineering Society was formed the first thing they would do would be to try and put the electrical engineer on exactly the same basis as the gas engineer was now, so that he could go to the consumer and advise him as to the best appliances to employ and the most suitable way of using them. Mr. J. S. Dow said the distribution of light and illumination was a very wide question; and he referred to a discussion on photometry in which most divergent views were expressed. What was wanted, he thought, was to get together people who held these different views, and find out what really was at the bottom of it all. They should have the views of the oculists on illumination, and those of architects as to the æsthetic side. It seemed to him that too much of the discussion had turned on the supposition that the Illuminating Engineering Society would be simply a society of gas and electric people got together to exchange views. But the question of the distribution of light and illumination was a far wider one than could be dealt with by them. How many Illuminating Engineers, he asked, were practising in America? He should think very few indeed. He did not doubt for a moment that everybody connected with lighting would do his own share of illuminating engineering, though he might not call himself one. They wanted a place where they could get together all the different results. At present the data were scattered. Let them get the people who knew something about photometry and lighting to meet together and find out what good lighting really did consist of. The arrival of the Illuminating Engineer in any case he imagined must be a question of years. Mr. F. Broadbent thought that, while Mr. Gaster had made out that illuminating engineering ought to be more studied than it was just now, he had not shown a good case for the introduction of a new specialist—the Illuminating Engineer.

In replying to the discussion, Mr. Gaster said the Illuminating Engineer would be an impartial authority who would tell the consumer what to do. If the consumer could go to somebody who had "no axe to grind," he would take his advice. It was only by the co-operation of the representatives of different illuminants that views could be exchanged.

Votes of thanks to the author and to the Chairman concluded a lengthy and animated meeting.

Scottish Junior Gas Association (Western District).—We learn from the Hon. Secretary (Mr. George Braidwood) that the members of the Western District Section of the above-named Association will visit the Stirling Gas-Works next Saturday afternoon, in accordance with the programme of arrangements prepared at the beginning of the session.

A New Gas in Germany.—Consul Samuel H. Shank, writing from Mannheim, describes as follows a new process of gas manufacture: "During 1906 there was built at the small town of Tostedt a plant for the manufacture of gas by the Dannert process. This gas is made from oil and coke and is similar to the water gas made in the United States; but it is claimed that the process is much cheaper, both in cost of plant and in production. The plant at Tostedt is only a small one, designed to supply a town of 2000 inhabitants; but its successful operation for several months has demonstrated the practicability and economy of the new process." A detailed statement shows an earning on the capital invested of 11 per cent. for the Dannert gas and of 5 per cent. for coal gas.

VENTILATION AND HEATING.

The members of the London and Southern District Junior Gas Association met at the Cripplegate Institute last Friday—the President (Mr. W. Upton) in the chair—to hear a paper by Mr. H. W. Harris, of the South Metropolitan Gas Company, on "Ventilation and Heating," the object of which was to show the great advantage of heating and lighting by gas as compared with heating by coal-fires and lighting by electricity. Unfortunately, however, it was very much too long to permit of the reading of the whole of it at "one sitting;" and it is to be feared that there was too much, even in the portion which Mr. Harris did get through, for the members properly to grasp all the various points that were introduced. After noting that the subject of ventilation and heating might be conveniently treated under the heads of (1) the amount of fresh air required, (2) the necessary amount of cubic space, (3) natural ventilation, and (4) artificial ventilation and heating, the author turned his attention to the last-named section—remarking that a proper grasp of the principles of ventilation, both natural and artificial, and of warming rooms, helped one very much when dealing with complaints of consumers about the supposed discomfort caused by the use of gas-fires.

Before entering upon the subject of the warming of rooms, Mr. Harris outlined the principles on which certain methods of heating are based; afterwards setting himself to practically apply these principles to the use of gas. Heat, he said, was communicated by radiation, conduction, and convection. The latter term was applied to the conveyance from one place to another of heat, by means of air; while conduction was the passage of heat from one particle to another—a very slow process in the case of gases. Practically, conduction and convection might both be considered under the head of convection. Radiant heat had been regarded by those competent to judge as the best means of warming, from a hygienic standpoint; the disadvantages being its cost and its feebleness at any distance. The cost could be lessened by proper arrangement; but the loss of heat by distance was irremediable. Radiating grates should be so disposed that every ray was thrown out into the room. When it was desired to place a gas-burner underneath a grate, for heating radiating material, rules given by Mr. Teale some years ago would (with the addition of an adjustable canopy) give what the author regarded as an ideal stove. These rules were: Use as much fire-brick and as little iron as possible. The back and sides of the fire-places should be made of fire-brick; and the sides should slope out to the front. The back of the fire should lean or arch over the fire. The slits in the grating and the bars in the front should be narrow. The chamber underneath the fire should be closed in front by a shield or economizer. He had in his own house found Edgar's "Blenheim" duplex gas-burner, fixed under an ordinary coal-grate, with a special back inside, most efficient, and the gas burnt silently. Each bunsen tube had a separate air supply, which ensured perfect combustion of the gas. In front and at the sides of the grate he had placed highly polished plates of untarnishable metal, with a similar plate over the chimney aperture, leaving just sufficient opening for the exit of the fumes. A large amount of heat was thus prevented from escaping up the chimney; and the highly polished reflecting plates projected a large amount of radiant heat into the room. In addition to this, the cheerful appearance of the fire was, of course, greatly increased. The duplex tap arrangement enabled the fire to be turned down, if desired, reducing the consumption by one-half—to about 20 cubic feet per hour. The "Blenheim" burners could be adapted to any existing fire-place that had sufficient depth under the grate. Edgar's special back placed in the grate projected forward, and radiated a large amount of heat into the room. Between this back and the back of the grate, there was placed a layer of slag wool, which prevented the heat from being conducted away by the ironwork and back part of the grate, where it would be wasted. The slits in the bottom of the grate were covered over by fire-clay, which not only radiated heat, but prevented cold air from being drawn in underneath the grate, which would cool down the incandescent radiating material. This arrangement provided a very efficient, fairly economical, and hygienic means of heating a room. The open chimney, which was a necessity for the use of radiant grates, was a strong argument for the use of this kind of warming.

When greater economy was desired, Mr. Harris said, convection and conduction must be employed. A plan which was proposed very many years ago for coal-burning stoves had been in general use for some time—*i.e.*, to have an air-chamber round the back and sides of a radiating grate, and to pass the external air through it into the room. Many gas-stoves were now constructed on this principle. The advantages were that they combined a good amount of open, cheerful fire, radiant heat, and chimney ventilation with supplementary warming by hot air, so that more value was obtained from the source of heat, and larger spaces could be more effectually warmed. The air-chamber should not be too small (or the air was unduly heated); and it should be possible to open and clean it. The hot air should, if practicable, enter so far up in the room as to ensure that it would not be at once breathed; and there should be no chance of its being immediately drawn up the chimney. A coating of silicate had been recommended as a preventative of the passage of deleterious products through an iron stove; and it would, the author thought, be an advantage where the ironwork of a gas-fire was likely to get very hot—thus obviating the charring of organic particles in the air, and so avoiding any unpleasant odour. A flue should always be provided for a gas-stove, though it need not be so large as for a coal-fire—say, some 3 or 4 inches in diameter. The remainder of the area of the house chimney could be conveniently employed for ventilating purposes, by the insertion of a ventilator connected from the top of the room. Ventilation could be more easily controlled with a gas-fire than a coal-fire, as the temperature could be kept more uniform. For lofty rooms—say, exceeding 12 feet high and over 15 feet square—an incandescent fire with warm-air arrangement was to be preferred. For bedrooms, it was a mistake to use small fires, which were of very little use. A bedroom, he maintained, required a larger fire than a sitting-room, simply because it was not constantly heated, and the warmth was wanted suddenly at very short notice. Absence of trouble was a great advantage which gas-fires had in bed-rooms over coal-fires. They required no attention, and would keep the temperature of a room uniform.

Turning to another point, Mr. Harris remarked that carbonic oxide existing about the fuel of a gas-fire might be forced into the room in various ways; but Mr. J. H. Brearley's tests had shown that many fires were now so well constructed that in only five out of twenty-four tests was there any trace of carbon monoxide given off by the fires otherwise than through the flue. In no instance did the trace exceed 0·35 of one part in 100,000 parts. After referring to down-draughts, the author said if the flue-pipe was luted air-tight into the chimney-space a lowering of the radiant heat would follow. The cause of this was evident, as an enormous amount of cold air was sucked in from the room over the surface of the incandescent material, which was cooled down at the expense of the radiant heat. Not only might the radiation be increased some 2 or 3 per cent., but a gas-fire of this class might be made as important an engine of ventilation as an open fuel-fire, by making the short gas-fire chimney act like the gas-injector of a bunsen burner, and draw in air from the room into the chimney well above the fire itself.

Mr. Harris found fault with the consumption of many existing stoves, and said he thought it quite possible for a stove to be constructed on scientific principles, and in such a manner that when used with the best kind of heat-radiating material, it would prove to be sufficiently economical, and give out enough radiant heat, as well as warm the room sufficiently by convection (within health limits), to oust its rival the coal-fire in many cases. In fact, from results of successful experiments, he has every reason to believe that he will be able to produce such a fire. Alluding to the suggestion to use for fires mantles of non-illuminating rare earth materials—mostly ceria—and Professor Lewes's opinion that ceria could only be utilized by making up the ordinary gas-fire fuel with certain forms of it, Mr. Harris intimated that he himself was carrying out experiments in this direction, but had not yet reached a definite stage.

The next portion of the paper dealt with experiments by the late Mr. Thomas Fletcher on the subject of the measurement of the amount of radiant heat from different classes of gas-fires. Numerous advantages of gas-fires were then set forth; and subsequently the author exhibited to the members the miniature room used by Mr. Brearley in order to experiment upon the direction of air-currents (inlets), and also to demonstrate the efficacy of the ordinary flue, but more particularly of an out-take above the lighting arrangement for ventilating purposes. Mr. Harris acknowledged his indebtedness to Mr. Brearley for the loan of the model, in which the members displayed great interest. Another matter which Mr. Harris had intended to deal with was the advantage of gas-lighted rooms as compared with those electrically lighted; but so much time had been occupied in the reading of the portion already referred to, that it was arranged to reserve this for another meeting later on in the session.

When Mr. Harris resumed his seat, a short conversational discussion ensued—principally consisting of questions by the members, and replies by the author, on various points arising out of the paper; and the proceedings concluded with a hearty vote of thanks to Mr. Harris for the great amount of trouble which it was freely recognized he had taken in the preparation of his contribution.

PRACTICAL ASPECT OF CYANOGEN EXTRACTION.

By Chas. H. Edmonds, of Birmingham.

[A Paper read before the Midland Junior Gas Engineering Association, at Birmingham, on Dec. 14.]

The distribution of nitrogen during the process of coal gas manufacture is a question to which much close study has been given. We, however, are only concerned now with its conversion into cyanogen. The cyanogen exists chiefly as hydrocyanic acid; it being doubtful if any free cyanogen is present or, indeed, produced during carbonization. The use of high temperatures appears favourable to the production of hydrocyanic acid; the ammonia which is first formed being probably decomposed in the presence of carbon according to the equation—

$$NH_3 + C = HCN + H_2.$$

According to published results, it would appear that, on the distillation of coal, about 1·6 per cent. of the nitrogen originally in the coal goes to form cyanogen. With increase of cyanogen

resulting from the use of higher temperatures, we look to find a corresponding decrease in the amount of ammonia produced; and in this connection it is interesting to note the comparative values of nitrogen as ammoniacal liquor and cyanide. The nitrogen content of 1 gallon of 10 oz. liquor and 1 lb. of crystallized Na_4FeCy_6 is practically the same; the actual figures being: 1 gallon of 10 oz. liquor is equivalent to 1·032 lbs. Na_4FeCy_6 $10H_2O$, so 1000 gallons of liquor would be equivalent to 1032 lbs. of crystal. Assuming a 75 per cent. extraction, we should obtain 774 lbs. of crystals for sale; and the value of these at, say, $3\frac{1}{2}$d. per pound, less, say, 2d. per pound for production, is £4 16s. 9d.; whereas 1000 gallons of 10 oz. liquor is worth, say, £3—showing the nitrogen in the form of ferrocyanide to be worth about 60 per cent. more than its value as ammoniacal liquor.

Nearly all the existing and proposed methods for the extraction of cyanogen aim at the manufacture of the ferrocyanide of sodium or prussiate of soda. This compound is quickly and surely replacing the potassium salt which, until about twenty years ago, was the only prussiate found on the market. The sodium salt acts equally as well as the potassium salt (in fact, in some cases better), and its relative cheapness should not be overlooked. Seeing that 484 parts of $Na_4FeCy_6 10H_2O$ are equivalent to 423 parts of $K_4FeCy_6 3H_2O$, with prussiate of soda at its present market price of $3\frac{5}{8}$d. per pound, prussiate of potash is only worth $4\frac{1}{8}$d. per pound, whereas it is quoted at $5\frac{7}{8}$d.

The available cyanogen for extraction is found to be about 4 to 5 lbs. calculated as $Na_4FeCy_6 10H_2O$ per 10,000 cubic feet, equivalent to 93·6 to 117 grains hydrocyanic acid per 100 cubic feet. As many people are in the habit of reckoning the cyanogen in terms of grains of hydrocyanic acid per 100 cubic feet, while an equal number calculate it as pounds of $Na_4FeCy_6 10H_2O$ per 10,000 cubic feet—*i.e.*, roughly per ton of coal—I have arranged a table to show the factors for conversion of grains of hydrocyanic acid to pounds of prussiate, and *vice versâ*.

Grns. HCN per 100 cub. ft.	× ·043 = lbs. $Na_4FeCy_6 10H_2O$ × ·037 = lbs. $K_4FeCy_6 3H_2O$	per 10,000 cubic feet.
Lbs. Na_4FeCy_6 10 H_2O	× 23·40	= grns. HCN per 100 cub. ft.
„ K_4FeCy_6 3 H_2O	× 26·87	
„ Na_4FeCy_6 10 H_2O	= lbs. NaCNS.	

In determining experimentally the amount of available cyanogen, consideration must, of course, be given to the method to be adopted for its extraction. The most straightforward—and, indeed, the easiest—is the polysulphide method; but this determines total cyanogen, and is somewhat misleading unless you propose to adopt this method on the manufacturing scale. Should you, however, have in view the production of ferrocyanide, the available amount should be determined by treating the gas with freshly precipitated hydrated ferrous oxide suspended in caustic soda. At present, should you decide to recover your cyanogen, you may do so either as sulphocyanide or ferrocyanide.

To recover as sulphocyanide, you are confined to one process—viz., that covered by the patents of the British Cyanides Company. It is dependent on the reaction whereby ammonium sulphide will dissolve sulphur, forming polysulphide which absorbs the hydrocyanic acid. It is a simple process, and requires but little supervision; and its extraction is very complete. A description of the method was given in a paper read before the Association by Mr. J. H. Willoughby in February, 1906.

We have now to consider the methods by which ferrocyanide may be obtained, and the basis of them all is to wash the gas with an iron salt in the presence of an alkali. The alkali used may be either a fixed one, such as soda or lime, or the gas may be treated before the extraction of ammonia takes place—the ammonia in this case entering into the reaction, and insoluble iron cyanides being formed. The processes into which ammonia enters have the advantage that the cyanogen which in the ordinary way would be retained in the ammonia washer is recovered. The gas is treated with ferrous sulphide (produced by the action of NH_3 and H_2S on copperas), and a double salt of ferrocyanide of iron and ammonia is formed.

Another process into which both ammonia and a fixed alkali enter is the Davis-Neill method, patented by the late Mr. G. E. Davis. Having had no experience with this method, and, in fact, never having seen the plant, I can only briefly describe it from printed descriptions, trusting that in the future some member may be enabled to give us the benefit of his experience with the process. It consists essentially of treating the gas, before ammonia extraction takes place, with a mixture of Na_2CO_3 and ferrous sulphide, prepared by the precipitation of ferrous sulphate with ammoniacal liquor. [Their newest patent deals with the precipitation of the copperas by means of strong concentrate from the still. In this way all the sulphate of ammonia produced is strong enough to run direct to the saturator; and thus all the sulphuric acid in the copperas is utilized.] This mixture, together with the ammonia in the gas, forms sodium ferrocyanide and insoluble ammonium ferrous ferrocyanide. It is passed through a column still where the ammonium ferrous ferrocyanide is converted into the sodium salt, and the ammonia recovered. At a lower point in the column still NaOH is introduced; and this converts the insoluble cyanide into soluble sodium ferrocyanide. The whole is filter-pressed, and the solution of sodium ferrocyanide, which contains about 8 grammes per 100 c.c., is concentrated and purified by recrystallization. The mud from the filter-press is returned to the washer to pass through the cycle of operations. The equations to represent the changes would be (as near as one can tell)—

(1) $4FeS + 5Na_2CO_3 + 18HCN + 2NH_3 = 2Na_4FeCy_6 + (NH_4)_2FeFeCy_6 + Na_2Co_3 + 4H_2S + 4CO_2 + 4H_2O.$

(2) $(NH_4)_2FeFeCy_6 + Na_2CO_3 = Na_2FeFeCy_6 + (NH_4)_2CO_3.$

(3) $Na_2FeFeCy_6 + 2NaOH = Na_4FeCy_6 + Fe(OH)_2.$

The striking point about this process is the very complete method for recovering all possible cyanogen; thus a very high efficiency may be expected. As the washing is carried out prior to the removal of ammonia, no cyanogen is lost in the scrubbers. Again, the washing mud is very thin, and is consequently easily dealt with in the washer and still, which will run for very long periods without any cleaning. Finally, a very pure prussiate is obtained.

The method which I desire to describe in detail is similar to that patented by the late Mr. W. Foulis, with the important difference that the alkali used is lime instead of sodium carbonate. The use of lime rather than soda tends to the formation of insoluble impurities which may be removed by filtration; whereas the sodium salts would remain in solution until time for crystallization, when they would prove troublesome. Again, a certain excess of alkali must be used; and the cost would be much heavier in the case of soda as compared with the much cheaper lime. I will describe very briefly the method, and then proceed to treat it in detail.

Ferrous sulphate (copperas) is dissolved in water and run into a mixer to which cream of lime (containing three equivalents of lime) is added, causing the precipitation of ferrous hydroxide and calcium sulphate with two equivalents of lime remaining. This mixture is run into a rotary washer, where the hydroxide is converted to sulphide, and the lime to carbonate; the hydrocyanic acid then being absorbed from the unpurified but ammonia-free gas, with the formation of calcium ferro-cyanide, according to the equation—

$$FeS + 2CaCO_3 + 6\,HCN = Ca_2Fe(CN)_6 + H_2S + CO_2 + 2H_2O.$$

The mixture is run off from the washer in the form of a black sludge, consisting essentially of a solution of calcium ferrocyanide (about 6 grammes per 100 cc.), insoluble $CaSO_4$, and unused FeS and $CaCO_3$. This is filter-pressed, and the sodium ferrocyanide obtained by precipitating the calcium salt with sodium carbonate—

$$Ca_2Fe(CN)_6 + 2Na_2CO_3 = Na_4Fe(CN)_6 + 2CaCO_3.$$

The solution is evaporated down, and the prussiate crystallizes out in a remarkably pure form.

The washer most generally used is the ordinary rotary type, containing either brushes or wooden bundles. On the whole, I think the bundles work best; there does not appear the same tendency for the mixture to clog. This failing seems specially noticeable in the first and last bays of the brush washer where the brushes are only fixed on the inside half of the revolving plate. I have seen a very neat device which obviates most of this trouble. It consists in fixing to the vacant half of the plate pieces of wood, about 7 in. by $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in., with the broad face hollowed out. As the shaft revolves, these hollow pieces carry up the "mixture;" and by originally fixing them horizontally there is a constant drip from them. With the present design of washer, unless specifically ordered, the speed rarely exceeds four to five revolutions per minute; and it is found that this speed will not allow sufficient "mixture" to be elevated. I have often observed that, with a washer making three revolutions per minute, the brushes carry the mixture a very short distance; and long before the brush has reached the highest point, it is merely wet. Thus the actual extraction must take place within a very limited area, and consequently is only more or less complete. Apparently the obvious way out of the difficulty is to speed-up your washer to run faster; but by so doing, you find the washer throwing heavy back-pressure. However, whatever type of washer be used, if the speed is at all limited, it results in more or less clogging, thereby reducing its efficiency and necessitating periodical cleaning.

A washer which appears to be much more appropriate, and likely to overcome many of the difficulties of the rotary type, is that designed by Mr. Walther Feld. I have not heard of its adoption in this country, but it is in use on the Continent; and though many of you are probably acquainted with its design, I will venture to briefly describe it.

There is a series of funnels T, arranged one in the other; and they are fitted at N to the vertical shaft W. Their lower edge dips into the washing-liquid, which is in the basin S. M is the casing, and L is a funnel-shaped baffle-sheet, the upper edge of which is held between two flanges of the casing. The diameter of the lower opening of L is less than the upper diameter of the basin S below. U is an overflow for the overflow of the washing liquid from the upper edge of S. C is a conical valve, by means of which the basin S can be quite emptied when cleaning the apparatus. D are the covers of the manholes, through which the separate chambers are accessible. The whole apparatus consists of a number of superposed sections M, each of which contains one of the above-mentioned washing arrangements. Below the lowest section there is an intermediate piece Z, with a ring R attached, by means of which the gas, coming from G^1, is forced to enter at the centre of the lowest section. Below the intermediate

piece there is the bottom piece B. The liquid from the basins S is here collected, and runs through an outlet-pipe A into a tank. To prevent any deposit of sludge in the bottom piece, a funnel with agitator R T is fitted to the shaft inside the bottom piece, which rotates with the shaft like the other diffusing funnels, and keeps the collected liquid in constant motion, and therefore the mud in suspension. The lower end of the washer, where the shaft passes through, is sealed; and the shaft driven by means of conical tooth or friction wheels. F is the base which supports the washer; and F K is the bed-plate to which the base is bolted, and which also serves as a foundation for the connecting shaft. On the upper section, is the headpiece K, the gas outlet G^{II}, and the inlet E for the washing-liquid.

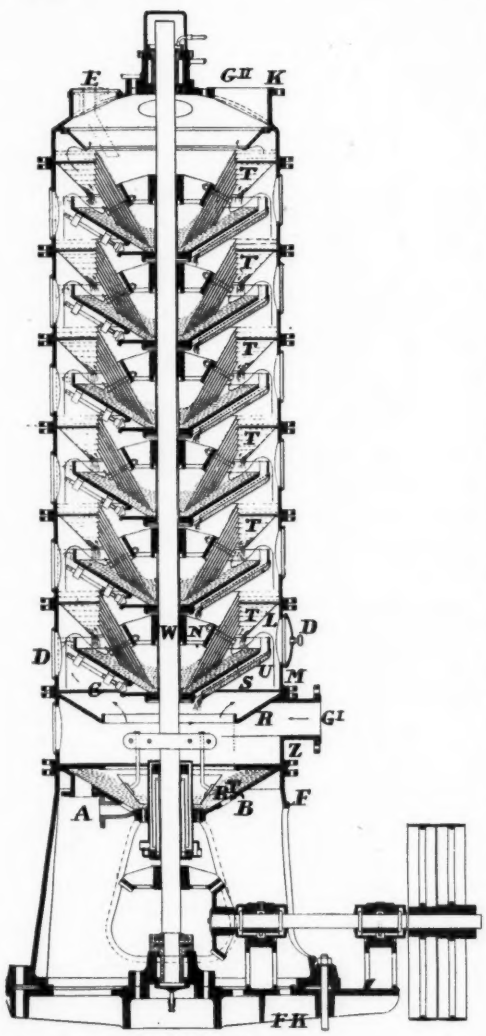


Fig. 1.—The Feld Washer.

The washer works as follows: The rotation of the shaft W and the funnels T at 100 to 120 revolutions per minute also causes the liquid in S to rotate. The surface of the liquid in the basin assumes a form as illustrated by the horizontal hatching in the sketch. The liquid in each of the funnels rises owing to the centrifugal force; and at the upper edge it is diffused horizontally, as illustrated. This finely sprayed liquid completely fills the space between the upper edge of the funnels and the casing M or the baffle-sheet L. The liquid so thrown at the casing runs along the baffle-sheet L back into the basin S. The gas follows the rotating motion of the diffusing funnels. Coming from G^1, it enters at the centre of the ring R in the intermediate piece *Z*, follows a concentrical course round the outside of the lowest basin S, and passes between the upper edge of this basin and the lower edge of L. It is then sucked in by the lower parts of the rotating funnels projecting out of the liquid, as shown by arrows. Rising in spiral form along the outside of the funnels, the gas now meets, at the upper edge of each funnel, the liquid coming from the interior of that funnel and together with it is flung off. The gas is treated like this at each funnel. It must, therefore, not only penetrate the various individual layers or strata of the diffused liquid, but is also at the same time mixed with the liquid and flung to the casing or to the baffle-sheet L. To some extent, the gas moves upwards in the form of a spiral line through the apparatus, which ensures intimate mixture of gas and washing-liquid. The impulse which the gas receives by the centrifugal power is such that there is practically no loss of pressure; whereas in rotary washers without exception the pressure decreases. Little power is required for the washer, amounting to scarcely 3 H.P. with washers which are capable of dealing with 10,000,000 cubic feet of gas per 24 hours.

It would thus appear that the Feld washer possesses great advantages over the rotary type—chiefly regarding its exhauster effect and consequent absence of back-pressure. The speed is such that it cannot get choked, even with muddy liquids; the intimate mixture of gas and washing liquid must increase the efficiency as regards extraction; and there appears to be no practical limit to the size of single washers. I understand there is one in the course of construction for dealing with about 90 million cubic feet of blast-furnace gas per 24 hours.

It is imperative, for reasons that will be mentioned later, that the gas to be treated should be quite free from ammonia and tar. If there is any likelihood of ammonia passing forward, it is well, with an ordinary rotary washer in use, to fit the last bay with a water supply for removing the final traces of ammonia; the outlet for the "mixture" having then to be fixed at the second bay. The "mixture" used for washing is prepared by dissolving copperas in warm water, and mixing with three equivalents of lime worked into a cream. The copperas is a commercial product corresponding with the formula $FeSO_4 7H_2O$. Unfortunately, it is showing a tendency to become a valuable salt, for its price has increased from 15s. per ton in January, 1906, to 30s. per ton in November, 1907. For dissolving the copperas, a wood tank lined with best chemical lead, and fitted with steam supply for heating the water, should be used. Iron tanks are useless, as they would only last a few weeks, owing to the small amount of free acid present in the copperas. The evident need for lead tanks may be realized when I tell you I have seen a 2-inch wrought-iron pipe, fixed in a lead tank and carrying exhaust steam to heat the water, completely destroyed in a fortnight. When all the sulphate is dissolved, the solution may be run straight to the mixer by a leaden pipe or trough; the latter being preferable, as it is more easily accessible for cleaning.

The lime to be used is a very important item, as you are dependent upon it in a large measure for your success. If possible, it is advisable to have a fresh supply daily—just enough to meet your wants for the 24 hours. Only large lumps picked by hand should be accepted; and if by chance you find yourself with any air-slaked lime, do not use it; for not only does it appear inactive, but it is a nuisance in subsequent treatment of your crude liquor. The lime may be worked up into a cream in small iron boshes of about 100 gallons capacity, and any stone, &c., kept out by passing it through two sieves of iron gauze, of about $\frac{1}{8}$-inch mesh. The copperas and lime are run, preferably at the same time, to an iron mixer containing timber paddles, which may be made to revolve off the washer shaft. The mixer must not be open to the atmosphere, with the exception of a small vent-pipe; otherwise oxidation of the ferrous salt takes place, and it is useless. The chemical change in the mixer is as follows:—

$$FeSO_4 + 3Ca(OH)_2 = Fe(OH)_2 + CaSO_4 + 2Ca(OH)_2.$$

In a paper read by Mr. Walther Feld four or five years ago, he advises the running of the iron salt and the alkali separately straight to the washer, the precipitation to take place in the first bay. This prevents any liability to oxidation of the ferrous salt, and would no doubt increase the efficiency of the washer, and save the cost of a mixing arrangement. The difficulties surrounding a system of continuous feed are rather heavy; and any advantage to be gained would hardly make up for the increased trouble. The mixture is of a nature that readily lends itself to the blocking of pipes, so making it necessary that the connection from mixer to washer should be of sufficient size, and as simple as possible, with no sharp bends.

The changes taking place in the washer have already been described; so we will proceed to examine the "slush" containing the calcium ferrocyanide which is run off from the washer. It is black in appearance, and contains roughly one-third solid matter, which is separated by means of iron filter presses. It is advisable to store filtered liquor rather than "slush," as the solid matter separates quickly, and before long you find yourself with such an accumulation as to cause trouble in filtering. In filtering, a good large press should be used; and I think it would be well to fit it with a washing arrangement, as the cake when removed from the press contains sufficient calcium ferrocyanide to pay for recovery. The amount, of course, depends on the pressure reached in the filter; but it is not unusual to find 2, 3, or even up to 5 per cent. of calcium ferrocyanide in the cake. A saving of labour, time, and filter-cloth would be effected by the use of a large press—say, for example, a 36 chamber 30 inch square iron filter, which will hold about 25 cubic feet of cake. However much care is expended on filtering, there are occasions when a little black liquor gets through—more especially when commencing filtering; for the merest pinhole will, until you obtain a hard cake, pass black liquor. So I would suggest placing an additional small press on the outlet of your large one, to retain any trace of solid matter. This might appear superfluous; but if not done, it is found necessary periodically to clean out the calcium ferrocyanide storage tanks. The cake removed from the filter-press is at first quite black; but on allowing to stand, it quickly assumes a brown colour, owing to the oxidation of the FeS, and consequent deposition of sulphur.

This change is very interesting, as pointing to the fact that some sulphuretted hydrogen must have been removed from the gas; and on experiments being made, it is found that with the washer working well a reduction of about 20 per cent. of sulphuretted hydrogen may be expected. What a help this would prove in the

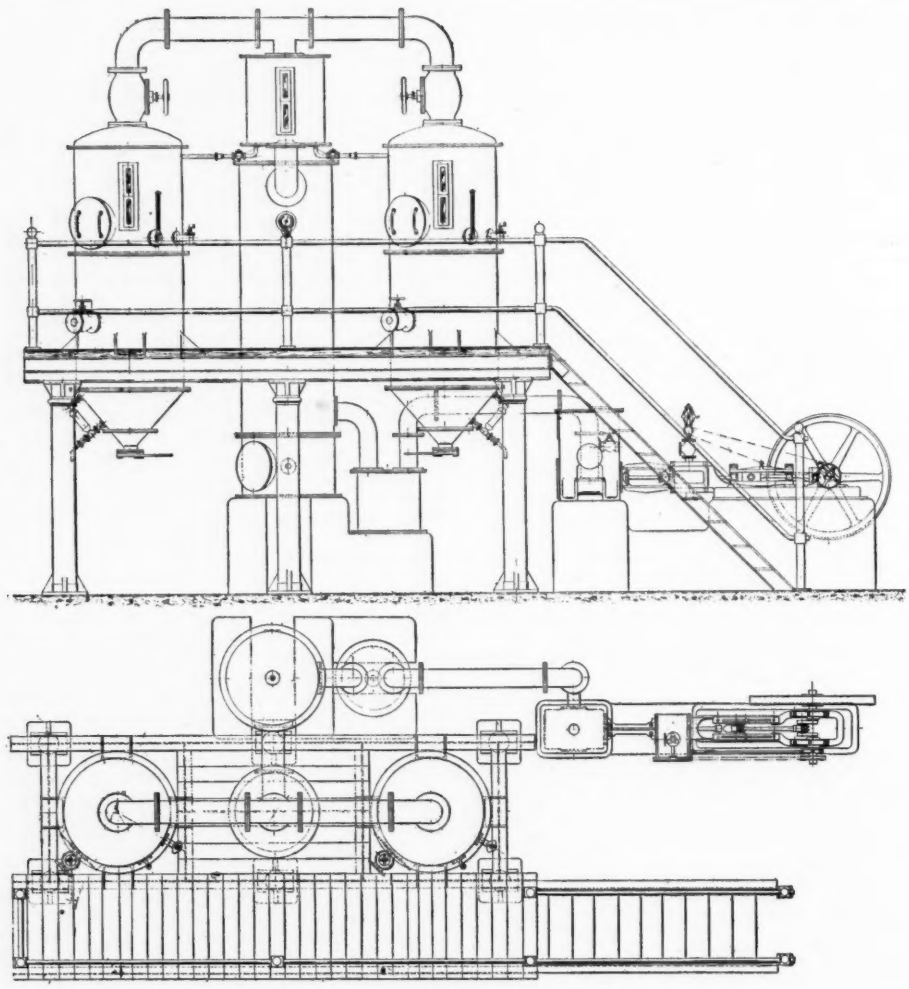


Fig. 2.—Scott and Son's Vacuum Plant.

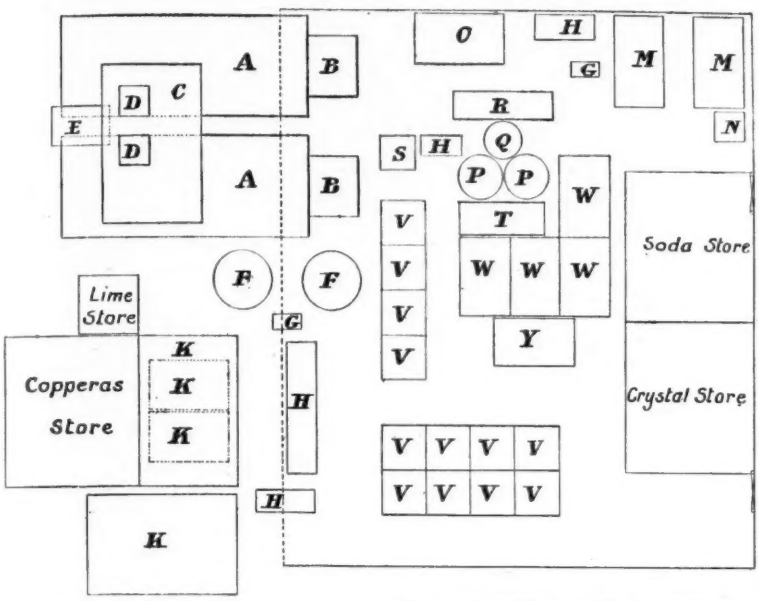
reduction of purification costs! Of course, it may be argued that for this reduction an extra amount of copperas is needed; but this is hardly correct, since for the maximum extraction of cyanogen much more than the theoretical quantity of copperas is used. According to the reaction, about 0·6 lb. of copperas per pound of crystal should be sufficient. Actually, about 2 lbs. must be used; and with this latter quantity the reduction of sulphuretted hydrogen is experienced. To return to the filter-cake, we discovered that there was a deposition of free sulphur resulting on the oxidation of ferrous sulphide; and the quantity is such as to point to a fair percentage of ferric oxide in the cake.

On submitting the cake to analysis, it is found to contain on the average about 25 per cent. of Fe_2O_3; and on mixing with a little sawdust it may be a useful substitute for oxide. An experimental fouling of the material has been made; and its behaviour has proved quite as good as that of ordinary oxide under similar conditions. Of course, the amount of available iron is much less; but, on the other hand, it exists in such a finely divided state that it is in an eminently suitable condition for absorbing the sulphuretted hydrogen. The clear solution of calcium ferrocyanide that passes through the filter is deep red in colour, owing to the presence of a little sulphocyanide, and contains about 0·6 lb. per gallon of ferrocyanide calculated as $Na_4Fe(CN)_6 10H_2O$.

It is usual to run about 80 gallons of this solution into the washer after the "mixing," as it appears to increase the activity of the solutions. I have found it a good plan to run this solution to the washer *viâ* the lime tank and mixer, as it helps to wash out any accumulated solid matter and renders periodical cleaning less necessary. The remainder of the calcium ferrocyanide is now converted into sodium ferrocyanide by the addition of sodium carbonate. It is usually done in wrought-iron precipitating tanks of about 1000 gallons capacity; the Na_2CO_3 being added in a hot solution of about 25 per cent. strength. The exact point of correct precipitation may be determined by filtering a few drops, and adding calcium chloride to one portion and sodium carbonate to the other. When no precipitate is produced with either, the liquor is just neutralized; but should a precipitate result from the addition of calcium chloride, it indicates an excess of soda, and more calcium ferrocyanide must be added. When the liquor is neutral, the calcium carbonate may be allowed to settle to the bottom of the tank, which it does more or less completely in about six hours, and the clear liquor run off by means of a swivel-pipe. This causes an accumulation of chalk in the tank, which must be removed frequently; but it soon reduces the capacity of the tank to a serious extent. Furthermore, even if the chalk be removed to a filtering-bed, and all the liquor allowed to drain off and be collected, it is found that there is still a fair amount of sodium ferrocyanide in the chalk. By using a small filter-press and pumping the liquor straight through as soon as it is neutralized, a great saving of time is experienced. The liquor does not require to stand for several hours; and no cleaning-out of the tanks being necessary, they are always of full capacity. Should it be decided to adopt the former method, a good plan is to shovel the chalk from a manhole in the tank, down a shoot on to a framework built up of ordinary purifier grids covered with sacking. The conversion to the Na salt is rendered necessary by the fact that calcium ferrocyanide is unstable at high temperatures and decomposes much more readily than the Na salt.

The weak solution of Na_4FeCy_6, which is found to have a specific gravity of about 1·02 to 1·03, has now to be evaporated to a suitable strength for crystallization. Broadly speaking, you have the choice of two methods—viz., with or without vacuum. While I cannot compare the two from actual experience, my work having only brought me into contact with the vacuum plant, they each have many advantages, and only practice with both can help one to form a judgment. The normal pressure evaporator does away with the need of any vacuum pump, a big item undoubtedly; but, on the other hand, a pump will be needed for supplying the evaporator which is, of course, unnecessary with the vacuum plant. Without vacuum, the temperature required would be much higher—in fact, it must be raised to its boiling point. To do this live steam must be used; whereas under vacuum, the temperature required being much lower, an opportunity is offered to utilize any exhaust steam from the remainder of the plant, and only a small quantity of live steam is required. But by far the principal reason for choosing vacuum plant is the less likelihood of any decomposition taking place under vacuum and out of contact of the air; whereas boiling a solution of Na_4FeCy_6 containing dissolved FeS, in contact with the air, is liable to lead to the formation of sulphocyanides with an equivalent loss of ferrocyanide.

Fig. 2 illustrates a vacuum plant designed by Messrs. George Scott and Son, Limited, of London, complete with two evaporators, condenser, and pump for dealing with 4000 gallons of liquor in 24 hours. The evaporators are fitted with 2-inch diameter tubes, and the steam circulates round them.



A. Washers.
B. Washer Engines.
C. Platform on Washers.
D. Copperas and Lime Dissolving Tanks.
E. Mixer.
F. Slush Sumps (Sunk).
G. Pumps.
H. Filter Presses.
K. Storage Tanks.
M. Precipitating Tanks.
N. Soda Dissolving Tanks.
O. Evaporator Feed Tank.
P. Evaporators.
Q. Condenser.
R. Vacuum Pump.
S. Settling Tank.
T. Liquor Boiler.
V. Vats.
W. Mother Liquor Tanks (Sunk).
Y. Hydro-Extractor.

Fig. 3.—Diagrammatic Plan of Suggested Plant.

The evaporation should be continued until the concentrated liquor contains about 5 lbs. of crystals per gallon, when it is run into a cylindrical boiler and live steam driven in until the pressure is about 30 lbs. The solution is found to contain a large quantity of black deposit which, of course, must be removed. It is chiefly ferrous sulphide, which passed into solution in the washer. On evaporating a known quantity of the Ca_2FeCy_6 and filtering off the deposit, it is found to amount to about 0·02 lb. per gallon. This is thrown down almost completely on evaporation. If any ammonia has by chance got forward into the washer, now is the time you find it out. The ferrocyanide solution has gone to form insoluble ammonia compounds, and the yield will be very small and poor crystals at that. In a case of this kind, I think the wisest thing to do is to get rid of the whole lot of affected liquor—swill it down the liquor well; for unless you have special means for dealing with these insoluble compounds, the ferrocyanide will hardly pay for the time and trouble involved in its recovery.

Now to return to our concentrated hot liquor. This is usually blown by steam pressure through a filter, to remove the solid matter. But an alternative scheme that I have found to work well is to blow the liquor into a wrought-iron settling tank fitted with steam-heating coil, allow it to stand for several hours, and, when clear, run off through a connection near the bottom of the tank to the crystallizing vats. Cast-iron vats of about 300 gallons capacity are very suitable, and should be covered by strips of wood about 2 inches wide, through which twine is passed at spaces of about 2 inches, having a small iron washer at the bottom to keep the string from floating. The crystals deposit on the string in a very pure form; and when the limiting temperature is reached the mother liquor may be syphoned into a storage tank, or run off if a suitable connection is made. It is then found that, apart from the crystals on the strings, there is a good crop formed on the sides and bottom of the vat. Those on the sides are generally fit for sale; but the bottom ones are of a poorer quality, and contain a small amount of dirt which necessitates re-dissolving, filtering, and re-crystallizing. The mother liquors are stored generally in underground tanks, until there is sufficient to evaporate for a crop of crystals. Generally speaking, the crystals from mother liquors are not fit for sale, and so are stored with the dirty crystals which on re-dissolving yield very good crops. After running off the mother liquor, all crystals for sale should be knocked off the strings and spun in a hydro-extractor to dry them. They are then casked, and are ready for sale. The temperature of the evaporated solution should not be allowed to fall below 30° C. (86° Fahr.), otherwise sodium sulphate is found in the crystals. Crystals formed above this temperature (which is the maximum solubility of the sulphate) are found to rarely contain more than about 0·05 per cent. of Na_2SO_4.

Arrangement of Plant.

When considering the necessary plant, there appears one special point to bear in mind. Do not commence by treating a small portion of your gas; for I question very much if cyanogen extraction will pay if treated as a large-scale experiment. Infinite care is taken to remove ammonia and sulphuretted hydrogen, and yet the hydrocyanic, acid which has a greater destructive action on metals than sulphuretted hydrogen, and at the same time is a valuable bye-product, is allowed to remain in the gas. For many years I believe the Germans have freed the gas from hydrocyanic acid, mainly owing to its action on meter drums, &c.

The arrangement of the plant depends very largely on local conditions; but I have made a rough diagrammatic plan based on my experience with two separate plants as a suggested design. It is for treating 6 million cubic feet of gas per 24 hours; but with the exceptions of the washers and evaporators, the plant would deal with an additional 3 million cubic feet per 24 hours. The evaporating and crystallizing plant should be enclosed within a building; and if this latter be made of galvanized iron, care should be taken to give it several coats of good paint, or a very practical proof of the action of hydrocyanic acid on metals will be obtained. The cost of such a plant I cannot definitely state; but I estimate it at approximately £5000, made up somewhat as follows:—

Washers, foundations, connections, and mixer	£2500
Tanks and vats	450
Pumps, filter-presses, and hydro-extractor	400
Evaporating plant and liquor boiler	650
Building	300
Steam-boiler and setting	100
	£4400

This allows £600 for extras.

Finally, we have to consider the cost of making our prussiate. Let us assume with the 6 million plant that we have 3 lbs. of prussiate per 10,000 cubic feet of gas and 80 per cent. extraction, which means we shall recover 2·4 lbs. per 10,000 cubic feet, or 4 tons of crystals per week. Our requirements per ton of crystals at the current market prices would be as follows:—

Copperas, 2 tons at 30s. per ton	£3	0	0
Lime, 1 ton 10 cwt. at (say) 14s. per ton	1	0	0
Soda, 10 cwt. at £5 per ton	2	10	0
Casks, four of 5 cwt. capacity at 4s.	0	16	0
Fuel, 10 tons at 8s. per ton	4	0	0
Wages, three men at 5s. and three at 4s. 6d. per day	3	0	0
Repairs (say)	0	3	0
Waste, oil, cloth, &c. (say)	0	5	0
Total	£14	14	0
10 per cent. depreciation on capital	2	10	0
3½ per cent. interest	0	15	0
	£17	19	0 per ton.

Or approximately 2d. per pound.
Value of prussiate at 3¾d. per lb., £33 17s. per ton.
Profit per ton, £15 18s., or on 200 tons make per annum, £3180.

Discussion.

Dr. W. B. Davidson (Birmingham) remarked that Mr. Edmonds had placed before the gas manager, in a very appetising way, the tempting morsel of some £3000 profit a year—that was to say, the gas manager who had at his disposal a coal-gas works making at least 6 million cubic feet per day. Such works, unfortunately, were few and far between; and he was rather disappointed that Mr. Edmonds had chosen so large a make. However, engineers and managers would feel very grateful to him for so fully explaining the practical and theoretical sides of this question of cyanogen extraction. Mr. Edmonds had made many valuable suggestions; other suggestions and remarks he (the speaker) did not quite agree with, and would like to criticize in a friendly way. The manufacture of prussiate from coal gas reminded one of the ancient recipe for hare soup—"First catch your hare." Here, they had to catch the gas; and unless they caught a very large quantity of it—the whole of it, if possible—it was no use trying to manufacture the prussiate. There was no doubt a small prussiate plant would not pay its way. He should say that, unless one could reckon on getting 2 million cubic feet of crude gas per day, at the present prices of chemicals and prussiate—which he saw that day had dropped to 3¾d. per pound—a good profit could not be made. At any rate, one was taking great risks. It seemed to him for a plant such as Mr. Edmonds had described, one required to stipulate for a much larger capacity. He had stated the capacity as

an average of 6 million cubic feet per day. He (the speaker) supposed that what was meant was 4 million feet in the summer and 8 million feet in the winter; and this would mean that there must be a capacity of at least 8 million feet. This, of course, would increase the capital outlay and the charge for depreciation and interest; but he would go further than this, and say that for the extraction of cyanogen by a muddy liquor from crude coal gas, one ought to stipulate for perhaps double the nominal capacity of the washers, as it was well known that, even with ordinary ammonia rotary washers difficulties were experienced with pressure when they were worked to their full capacity. If this was the case when one used water or a clear liquor, it was particularly desirable when a muddy liquor was employed to make sure that the capacity was large enough. Though the capital outlay would be more, and the annual charges also heavier, the efficiency would be much greater, and success would be assured. Not only did one require larger capacity in washing the gas, but also, he thought, in evaporating. Mr. Edmonds did not seem to him to leave sufficient margin in his evaporating. Apparently, he would get about 3000 gallons a day to evaporate; and his capacity was only 4000 gallons a day. Plants of this style were known to have difficulties in working up to their full capacity; and he should say the capacity here given ought to be doubled. In the selection of a washer, no doubt the Feld type offered great advantages. They did not know sufficient about it as yet in this country; and one would like to ascertain whether there was a danger of the mud being thrown against the walls and sticking there, and whether there was any difficulty in getting a continuous supply of the liquor to the top of the washer. In choosing an evaporator, sight must not be lost of this fact—that with a vacuum evaporator a large volume of water was required to pass from the condenser so as to allow the vacuum to be obtained. He had seen as much as 5000 gallons an hour passing from a condenser with an evaporator evaporating only 150 gallons an hour. Where river water was not available, and it was necessary to use well water, the charge for pumping would be serious, and might amount to as much as 10s. a day; but, as Mr. Edmonds said, both kinds of evaporator—vacuum and non-vacuum—had their special advantages. Mr. Edmonds spoke about the purification of coal gas from hydrocyanic acid. Did he not forget that iron oxide removed the great bulk of the cyanogen in the gas, and that purified coal gas contained very little—according to tests he (the speaker) had made, certainly not more than 20 per cent. of the total hydrocyanic acid in the gas.

Mr. J. Darrah (Adderley Street) remarked that in the case of a manager anxious to seize any opportunity of securing additional revenue, there were several general questions requiring a definite answer before deciding to lay down a cyanide plant. It was generally agreed that cyanogen was a high-temperature product; and so the conditions most unfavourable to carbonizing were the ones most favourable to a high production of cyanogen. Among the present systems of carbonization, inclined retorts, worked at a high heat, appeared to him to present the conditions most favourable to the production of cyanogen. In this system, there was a comparatively long travel of the gas over highly-heated coke, and (owing to its different physical structure) more intimate contact with the carbon hanging from the crown of the retort than would be the case with horizontal retorts. The lower yield of ammonia usually associated with inclines seemed to bear out what he had said. Perhaps Mr. Edmonds would say whether his experience confirmed this. At a small direct-fired works, with consequent low heats, extraction would not pay. Thus, first of all, the number of works which could make the extraction a financial success was limited; and, secondly, it depended upon the temperature of carbonization even at a large works. Since Mr. Edmonds did not specify any particular method of extraction as the best, it was to be assumed he would recommend the one described in detail. He (the speaker) thought it was the worst one mentioned. To begin with, an ammonia-free gas was essential to its success; and during a hot summer, unless one had ample condensing area, it was not easy to keep the gas at a temperature suitable for the complete extraction of ammonia, and at the same time maintain the ounce strength. Again, the rotary washer he considered an altogether unsuitable form for the method the author recommended. It was always clogging up, and threw an excessive back-pressure. In the table of costs an item should be added for the cost incurred in overcoming this. Was the price quoted for materials delivered at works? It would be noticed that a large excess of copperas was needed to allow for that rendered useless by absorbing the sulphuretted hydrogen. The purifiers got credit for this, though it did not impress one as economical purification. The cost of repairs he considered should be at least doubled. There were also several items—such as commission on sales, freight, cost of cartage of fuel to boilers and disposal of ashes and residual sludge, and cost of water, supervision, insurance, stationery, &c. The author's figures were taken on a basis of a 6 million feet plant; and Dr. Davidson had already made some remarks on this. If it was an average of the summer and winter production, he could hardly claim an equal efficiency with the maximum and minimum production. In fact, the efficiency dropped with the minimum. To his mind, the British Cyanide Company's method was the best. The low first cost and little trouble required, combined with efficient extraction, were bound to make an impression. Dr. Davidson had also remarked on the oxide taking out the cyanide. Some works he had in mind sold their oxide at a price per unit content of cyanide, in addition to the sulphur content. It might interest the chemical members to know that the most satisfactory method of its estimation at a large gas-works was the volumetric one against zinc sulphate, using ferric chloride as an indicator. He would like to ask Mr. Edmonds if he had any figures to show what variation he found in the cyanide content of oxide between inclined and horizontal retorts; and for the purpose of obtaining an expression of opinion from the members, he ventured to submit that the costs shown by Mr. Edmonds were incomplete, and his estimated profit unrealizable in practice.

Mr. J. H. Willoughby (Leamington) said that his experience was not with a ferrocyanide plant; but the paper would enable him to compare the method of working referred to with the one he (the speaker) advised—namely, the sulphocyanide—in a paper that he read before the Association early in 1906. He was very much struck with the first cost of the ferrocyanide plant, as compared with the sulphocyanide. He reckoned it was more than double. And there were also the heavy working costs and labour costs. Dr. Davidson had referred to the restriction of the figures to a 6 million cubic feet a day works. He was going to ask if it was possible to operate the system on a 1 million feet works so as to produce profit. He should question if it was. Of course, they knew that, with the crystals, there was a chance of getting a better price for the cyanogen; but in a medium-sized works, the question naturally arose whether this small extra profit would pay for the larger first cost over sulphocyanide plant. In the discussion which followed the reading of his own paper, Mr. Edmonds took exception to the small quantity of nitrogen which was given as being returned as cyanogen—1·56 per cent. On that occasion, Mr. Edmonds thought he (the speaker) ought to have given the results of a lot of German experiments where, with high heats, they had as much as 29 per cent. of their nitrogen returned as cyanogen. Now, Mr. Edmonds, in his paper, said: "According to published results, it would appear that, on the distillation of coal, about 1·6 per cent. of the nitrogen originally in the coal goes to form cyanogen." It was gratifying to him to read this, because it proved that Mr. Edmonds had come round to his way of thinking, and that the figures he gave last year were satisfactory. With regard to the diagram of the Feld washer, was this supposed to be correct? Mr. Edmonds said it was capable of passing 10 million feet in 24 hours. He made the gas-inlet out to be about 8 inches diameter. If they took it to be 24 inches diameter, then the tower on the corresponding scale would have to be 60 feet high, which would be tall even in these days of tall things. In fact, considering all things, he thought it hardly feasible.

Mr. C. C. Barber (Birmingham) said that as to the nitrogen which went to form cyanogen, he thought a better figure than 1·6 per cent. of that in the coal would be 2 per cent. of that in the coal, or 15 per cent. of that in the coal gas. As to the heavy back-pressure said to be found on increasing the speed of rotary washers, he had made some tests and found that, with wooden bundles, speeding-up the washer 2 to 4 revolutions per minute made practically no difference in the pressure; but with brushes, there was a difference of about 2½ inches. Then the author referred to the clogging up of brushes. This was generally due to allowing the plant to stand at the week-end. If it was kept continuously working, he did not think clogging would take place. Mr. Edmonds alluded to ammonia in the gas going forward to the scrubber, and said he put water in the last bay for extracting the final traces of ammonia. He thought he meant he put water in the first bay, and had the outlet for the mixture in the last bay. Later on the author told them they should not use air-slaked lime for extraction. Well, on one occasion at his (the speaker's) works there were about 8 tons of air-slaked lime; and as they could not afford to throw it away, they had to use it. It gave little trouble, and the liquor was very strong. He did not say air-slaked lime was the best. Of course, quicklime was better when it could be obtained. As to the use of the filter cake for purifying purposes, he doubted very much whether it would pay to employ it for extracting sulphuretted hydrogen. In the first place, it must be dried either by spreading it out and allowing the air to dry it or by the application of external heat. After it was dried, it had to be broken up and put into the purifying-boxes. He saw some that had been used for this purpose; and when the box was opened the cake was found to be very hard, and required a good deal of extra labour to take it out. He questioned whether they could sell it; and if not, they lost the sulphur. As to the filter-press for precipitated liquor, unless the man was constantly stirring up the mud in the tank it settled, and it was necessary to clean out the tank periodically. If there was a spare filter-press, he should say put it in; but they should not buy one. To his mind, running off from the tank was best. The author said if there was any ammonia found in the liquor, the wisest thing was to get rid of the liquor; but this would be expensive. He had seen liquor affected in this way worked up into very good crystals. Mr. Edmonds said the crystallizing vats should be covered by strips of wood about 2 inches wide, through which twine was passed at spaces of 2 inches. If the wood was so narrow, and the strings so close together, the crystals would form in one solid mass. He suggested that strips of wood 3½ inches wide, and strings about 3½ inches apart, would be much better. In connection with vertical retorts he had heard there was a larger yield of ammonia and a less yield of cyanide.

Mr. W. J. Pickering (Birmingham) said that with regard to the factors for converting pounds of prussiate per 10,000 cubic feet into grains of hydrocyanic acid per 100 cubic feet, the factors

greater than unity were given to four significant figures, and those less than unity should be expressed to the same degree of accuracy, which would make them 0·0426 and 0·0372 respectively. As to the equations for reactions in the Davis-Neill process, in the first one Na_2CO_3 occurred on both sides. Did this indicate an excess to be present? In the same equation, two parts of soluble cyanide and one of insoluble cyanide were represented as products. Did this imply that they were formed in this proportion? He had it on good authority that the percentage of insoluble cyanide formed was about 10 only—sometimes 5. A better way to suggest the changes taking place would be, he thought, to give first an equation for the main reaction—the formation of $Na_4Fe(CN)_6$, —and then show the production of the insoluble cyanides in subsidiary equations, which merely represented minor reactions occurring. Then the equation given for the change in the washer, when treating the method described in detail, did not express, he thought, the main reaction. There was an excess of lime in the mixer, and hence $Fe(OH)_2$ would be the chief iron salt taking part in the washer reactions. This combined with the HCN to give $Fe(CN)_2$; and the latter united with the $Ca(CN)_2$ to form $Ca_2Fe(CN)_6$. The sulphide reaction was of minor importance, and probably only took place in the presence of ammonia. When speaking of the hot concentrated liquor run from the evaporator into the boiler, Mr. Edmonds mentioned the production of a black deposit which had to be removed. Besides FeS, this deposit contained the insoluble cyanides which had been formed; and the greater the amount of ammonia that had passed in the gas through the washer, the larger would be the percentage of insoluble cyanide in this deposit. But it took a fair amount of ammonia to so seriously interfere with the crystallization as to warrant the drastic remedy of running the affected liquor into the liquor well. He had seen liquor containing ammonia to the extent of 1·4 oz. strength produce very fair crystals. He thought even in an extreme case of this kind the liquor should be allowed to give what crystals it would, and the deposit be treated for the recovery of the insoluble cyanides it contained. He had examined samples of this deposit containing 22 per cent. and 65 per cent. of equivalent soluble prussiate; and he thought it would pay to extract the deposit, even in ordinary normal working, rather than throw it away at once. As to the method of removing the deposit from the hot concentrated liquor, he had tried both settling-tank and filter-press, and on the whole preferred the latter. The settling-tank possessed several disadvantages. As to the time at which cystallization should be arrested, he had found that the temperature of the evaporated solution in the vats might be allowed to fall as low as 75° Fahr. without the inclusion of 0·1 per cent. of Na_2SO_4 in the crystals. The roof of the building in which the plant was housed might with advantage be made of wood, so as to better resist the action to which it was subjected.

Mr. P. C. Balcon (Birmingham) remarked that the British cyanides process was an extremely efficient method for extracting cyanide; and if it paid the Company to take the liquor away from the works and then work it up, did they not think it would be much better to carry on the manufacture "on their own," and get their crystals themselves?

The President (Mr. W. E. Caton, of Derby), in proposing a hearty vote of thanks to the author, said he had not so far had any experience with a cyanide plant; but one was now being put down at Derby. He hoped, therefore, that on the occasion of the reading of the next paper on the subject before the Association, he might be able to take part in the discussion.

Mr. J. Hewett seconded the vote of thanks, and said the portion of the paper which appealed to him most strongly was that dealing with the suitability or otherwise of the various kinds of washers. The consistency of the "black sludge" referred to by Mr. Edmonds subjected the shaft and other revolving parts to a very heavy strain; so much so that in a washer of a nominal capacity of 3 million cubic feet of gas per diem, the spiders, to which the wooden bundles were fixed, were forced out of position, and the steel shaft, 5 inches in diameter, was broken. Though the latter was replaced by a shaft 6¼ inches diameter, the same thing occurred again, and the present shaft 6½ inches square was put in. Mr. Edmonds stated that the washer designed by Mr. Feld "appears much more appropriate, and is likely to overcome many of the difficulties of the rotary type;" but he (the speaker) noticed he did not add, after the word difficulties, "while retaining the advantages." To him it would appear that the black sludge was likely to stick to the sides of the casing (as suggested by Dr. Davidson) and to the baffle-plates, and (as no scrapers or brushes were provided to keep these clean) to gradually build up and choke the gas-way. Further, it would probably choke the space between the funnels. In any case, cleaning out must at some time be necessary; and this could not be done properly without removing portions of the casing—a risky proceeding in the case of a vertical washer. Comparing the details of the different washers, he considered it more difficult to clean out the Feld washer than any other. It was at times necessary to return the mixture in the last chamber to a preceding one; and this would necessitate pumping in the case of the Feld washer, whereas it was done by gravity in other types. Another disadvantage was that in the Feld washer the gas had relatively a much shorter travel in contact with the washing liquid. The paper had been a very interesting one.

Mr. Edmonds, after acknowledging the vote of thanks (which was heartily accorded), said he was not holding a brief for the Feld washer, but it appeared to him to be a very suitable type, and (from his experience of the ordinary rotary washer) to overcome a great many disadvantages which the rotary form possessed. His first equation for the Davis-Neill process was worked out from the patent specification, where it was specifically stated that an additional molecule of sodium carbonate must be put into the washer because it would be required later on; and they would see in Equation (2) it was required. He had sent the equations on to Mr. Davis, who said that, so far as one could tell, they exactly represented the changes that took place in the process. As to the equations in the process of which he gave a detailed description, it seemed to be generally accepted that the ferrous sulphide was the active agent. Dr. Colman, in a paper he read some years ago, gave the same equation, and regarded the ferrous sulphide as the active agent. He was pleased to see there were some people who had been able to treat liquor containing ammonia, and get decent crystals. He had had experience with about 5000 gallons; and all he got was between 2 and 3 cwt. of crystals, which had to be re-dissolved before anything could be done with them. Mr. Barber had put him right on the question of the bays. He meant the last bay should be filled with water, and the last but one should be the outlet for the slush. His figure of 1·6 per cent. of the nitrogen in coal going to form cyanogen, was a rough average of the figures he had at his disposal. The diagram of the Feld washer had been reproduced from a sketch supplied to him. The dimensions of a washer for treating 7 to 12 million cubic feet per 24 hours were: Total height from the floor, 21 feet; casing diameter, 85 inches; gas-inlet diameter (maximum) 29½ inches. His objection to the British cyanides process was: "You do the work, and they get the money." Mr. Willoughby in his paper gave a capital outlay of £950, and told them he had received in 2½ years £374 4s. 5d. Worked out, this came to £150 a year profit, or 15 per cent. on the capital outlay. This was reckoning nothing for depreciation. If 10 per cent. was allowed for this, the profit would be reduced to £55, which was only 5 per cent.—not a great deal, considering they had already got the cyanogen on the works. Personally, he did not think the ferrocyanide plant did pay for very small works; but, on the other hand, was the sulphocyanide plant worth putting down for (say) a million cubic feet works? He did not know how much gas Mr. Willoughby treated; but, to his mind, £55 per annum was not a great return for any plant. He agreed that cyanogen was a high-temperature product. He had noticed himself that with the use of inclined retorts the yield of ammonia was low, and that of cyanogen was high. With works using horizontals and low temperatures, there appeared to be very little cyanogen in the gas. He knew of low-temperature works where the average would not be more than 1 lb. of available cyanogen for recovery. Mr. Darrah said that the method he (Mr. Edmonds) described was the worst one; but on this they must agree to differ. In the method he had detailed, one secured a reduction of impurities; and if it was possible to reduce the impurities some 20 per cent., this was a great advantage. In the Davis-Neill or the Foulis process, they were using sodium carbonate; and, for all they saw, they were putting in carbonic acid that they had to take out later on. This would increase the purification costs; whereas with the other method they were reduced. He thanked Dr. Davidson for the kindly way in which he had criticized the paper. On the question of cost, Dr. Davidson said that with increased washers they would have increased efficiency. But in the table only 3 lbs. of crystal was allowed for in the gas; whereas it was quite possible to find many works the average of which would be nearer 5 lbs. than 3 lbs. With increased washing arrangements, the efficiency could be increased from 80 per cent. to 90 or 100 per cent.; and with this increased efficiency, and the increased amount, there would be a greater yield. He had taken in his costs the outside figures. Instead of painting an ideal plant, he had put things a little on the wrong side. His sketch was for a plant to deal with 6 million cubic feet of gas per day summer and winter—not 4 millions in the summer and 8 millions in the winter, but 6 millions a day right through the year. And they could, as he said, deal with an additional 3 million feet with all the plant except washers and evaporators. No doubt an additional evaporator would be well; but it would increase the capital outlay a little—perhaps £200. He would like to know whether the plant referred to by Dr. Davidson was working under proper conditions when 5000 gallons of water were required for 150 gallons evaporated. This seemed tremendous. Of course, the amount depended very much upon temperature considerations. As to the hydrocyanic acid left in town gas, Dr. Davidson mentioned 20 per cent. He had seen tests which came out as high as 1·88 lbs. of ferrocyanide per 10,000 cubic feet. This was rather high; and 20 per cent. he thought would be nearer the mark. But even 20 per cent. would do damage; and if they could make money by removing it, he thought it worth while doing so.

Water Supply in the Rhondda Valley.—Mr. Justice Warrington was engaged from the 4th inst. until last Friday morning in hearing an action brought by the Attorney-General, on the relation of the Rhondda Urban District Council, to obtain an injunction to compel the Pontypridd Water-Works Company to carry out their statutory obligations to furnish an efficient supply of water within certain districts of the Council's area. The case was, however, settled last Friday. Our report is in type, but is unavoidably held over till next week.

SUPPLY OF GAS TO PRIVATE DWELLINGS.

[A Paper read before the Midland Junior Gas Engineering Association, at Birmingham, on Dec. 14.]

By W. E. Cadwallader, of Birmingham.

The supply of gas to private dwellings appears such a simple subject that at first sight it seems scarcely important enough to write a paper about. On looking more closely into the matter, however, one feels that there is more in it than appears on the surface.

Importance of this Class of Consumer.—Gas is so generally used in our private dwellings nowadays and, in comparison with our factories and shops, so little is used per consumer, that their importance is apt to be somewhat overlooked. But when we realize the thousands who are using gas in this way, and that, in many towns, the major portion of the gas made is used by them, we shall better understand the necessity for catering for them, and of trying to extend their number and increase the demands of those we already have. There are several methods of obtaining more custom—among others advertising, canvassing, exhibitions of gas lighting, heating, and cooking appliances, lectures on cookery, &c. With regard to advertising, many municipal gas departments are debarred from advertising or canvassing, by the (shall I say?) jealousy of the private gas-fitter, more especially if the gas department undertake gas-fittings, or the sale of fittings and other appliances. With gas companies no such consideration applies, and many have materially extended their business by judicious advertising. It must not be forgotten, however, that the best advertisement is obtained, not from the Press or poster, but from satisfied consumers. The oft-repeated remark: "I do not know what I should do without my cooker," makes far more impression than any amount of advertising. On the other hand, if consumers are not satisfied, their complaints will tend to keep away new customers. This being so, the successful manager must be able to reduce complaints to a minimum.

Complaints: Their Nature and Remedy.—Only a small percentage of the complaints received refer to escapes; but it is imperative that they should have first and immediate attention. When we remember that any mixture of gas and air is explosive within the limits of 1 in 6 to 1 in 16, and that there are still clever people about who know that the quickest way to find an escape is with a naked light, we see the importance of promptness in dealing with such cases.

When testing to see if pipes and fittings are sound, the pressure-gauge or one of the leak-testing machines should be used. The old-fashioned method of watching the small wheel above the index of the meter is quite out of date. The common pressure-gauge is the most simple and convenient means of testing now employed. It is very simple to use; the gauge being attached to one of the fittings, the gas turned on, and the pressure noted. Then the gas is turned off at the meter, and the gauge watched. If the pipes and fittings are perfectly sound, the water will remain constant at the pressure noted; but if there be any leak the gauge-water will become level more or less speedily, according to the size of the escape. The time that elapses between the gas being turned off and the water becoming level is an indication of the extent of the escape. A small house may be considered practically sound if the water drops less than 1 inch in five minutes; but a larger house, owing to the greater volume of gas in the pipes, should take fifteen minutes, or even more, to drop this amount. The causes of escapes are so various—from faulty pipes and fittings to carelessness or accident—that it would be unwise to attempt any classification in a paper like this; so we will at once proceed to the next series of complaints—viz., bad lights.

Probably the most prolific cause of complaint during the past few years has been naphthalene. The problem of how to get rid of this, or how to prevent its deposition in mains, services, meters, &c., has been one of the most difficult the gas manager has had to solve. But thanks to the enterprise of gas chemists and engineers, methods of overcoming this source of trouble have now been discovered.

A large number of the complaints of bad or no lights are caused by the meters, more especially those of the wet type; but frequently they are only short of water. In cold weather, particularly if in exposed positions, the water in the meter is very liable to freeze; and if the cold is very severe, the resources of the gas department are often taxed to the utmost to cope with the trouble. Consumers whose meters are so exposed should be advised to protect them with some non-conducting material and screen them from any keen draught. Then, again, any abnormal pressure may blow the water over, and so put the meter out of action. Most of them being made to stand a pressure of about 3 inches, an increase of pressure such as is frequently adopted for automatic street lighting may cause many complaints. These things, together with the time occupied in watering, have caused many gas undertakings to gradually discard the wet for the dry meter, which (though often faulty and inaccurate years ago) has now been brought to such a high standard of excellence as to fully justify its increased use.

Another frequent source of complaint is faulty carcassing. The best time to lay the pipes in a house is undoubtedly during the course of erection, when only the carcass or skeleton of the house is built, and before walls are plastered or floor boards laid. The advantages, both structural and economical, are so obvious, that this is the usual method adopted by builders. Unfortunately, thousands of houses are fitted up with pipes much too small. Competition among gas-fitters and plumbers for this class of work is so keen that prices are cut far too low to do it properly. When we hear of houses being fitted with pipes at 2s. per point, including materials, we can conclude that something must be wrong, as, to do the work properly, materials alone would come to as much as, or more than, this. We can better understand, under these circumstances, why gas-fitters will supply ten lights from $\frac{3}{8}$-inch iron and six from $\frac{1}{2}$-inch pipe—not isolated examples by any means. What can be done to remedy this? With regard to houses already fitted, very little, unless they are refitted or else have an additional outlet from the meter to the remote portions of the house to boost the supply. In the case of new buildings, I think much may be accomplished. More often than not, the builder does not understand gas-fitting, so he simply asks for a price to run pipes to so many positions, leaving it to the gas-fitter to do the work properly.

I think that it would be a very good plan for gas companies to have an inspector who is a thoroughly practical fitter (possessing plenty of tact, of course), to call upon builders who are erecting new houses, and advise them concerning arrangements for gas fitting, position of meter, lights, and size of pipes. At the same time, he could recommend cooking-stoves—pointing out that it is cheaper to run a stove supply-pipe to the scullery than to fix a grate there; the recess usually occupied by the fire-grate being left for the gas-cooker. This has been done in many cases; and tenants appreciate the change very much. He can also advise the builder that it is really cheaper to have the houses properly carcassed in the first instance than to have the work done in a "jerry" manner, frequently to find when everything is finished that the pipes are too small, stopped up, or leak—necessitating alterations which often entail more or less damage to the property, to say nothing of the annoyance and expense involved in setting things right. When one good builder has been persuaded to run stove supply-pipes in houses, others quickly follow his example; for it is a consideration with many intending tenants to find that they can have a cooker without the inconvenience of having pipes laid.

As a further inducement, I would suggest that the gas company offer a special discount on the charge usually made for laying private services, to all builders carcassing their houses properly. This might be in proportion to the work done, and would compensate in some measure for any extra expense involved in fitting up. For instance, if pipes for lighting purposes only are fitted, of a size approved by the gas company, 5 to 10 per cent. may be allowed; if the stove supply is run as well, say, 20 per cent.; while if pipes are laid for gas-fires in addition to the above, still further reductions may be made. Instead of a percentage discount, a specified sum could be granted off each service, so that those with short service-pipes could benefit equally with those having longer ones. Where new estates are opened up, concessions somewhat on the lines mentioned would undoubtedly bring about good results; for many tenants, on finding pipes run for cookers, would not hesitate to have them fixed; and if pipes were laid for fires, they might probably also be induced to try them. It is without doubt the expense of having pipes laid that debars many from going in for these appliances, more especially where the length of tenancy is uncertain.

Perhaps a few general rules with regard to fitting-up houses will be acceptable here.

Services should be as short as possible, and never carried farther into the house than necessary. The system of laying services under the rooms of a house should be altogether condemned.

The position for the meter should always be against one of the outer walls of the house.

The pipes in the house should be sufficiently large to do the duty required of them, and also to allow for some corrosion.

The rising main should be never less than $\frac{1}{2}$-inch (inside bore) up to nine or ten lights. For more than this, or where cookers or fires are required, $\frac{3}{4}$-inch or larger should be used, as deemed necessary.

All pipes where practicable should have a slight fall either to the meter (if a wet one) or to suitable syphons. In places where joists have to be cut, lay pipes level.

All syphons should be easily accessible, and of a capacity that will obviate too frequent emptying.

No pipes of less internal diameter than $\frac{1}{4}$-inch iron or $\frac{3}{8}$-inch compo. should be used; and these only for one or at most two lights.

All drop-pieces should be firmly fixed, and if coming midway between the joists should be supported by suitable bridging.

Where brackets are wanted, the walls should be securely plugged; a half-brick cut out, and timber firmly inserted, making the best job.

No more fittings or syphons should be used than are absolutely necessary.

When fitting houses up with compo., the blowpipe should be used for making joints, instead of the copper bit. Care should be taken not to kink the pipe when bending, as the bore is sometimes reduced 50 per cent. or more through carelessness in this respect. The drop-pieces should be of copper, so fixed as to take all strain from the compo when screwing a pendant up or down. Suitable bridging should be fixed to take the weight of the pendant, which must never be allowed to be supported by the copper.

Unfortunately there are numbers of gas-fitters who simply fix a short piece of brass (about 1 or 2 inches long) on to the compo., and thrust it through the ceiling; the result being that, on the pendent being screwed up, the compo. gets twisted, a bad light

follows, and when the pendant is taken down, the compo. is often broken, necessitating the drop being fixed properly.

Incandescent Mantles.—Invention of the incandescent mantle has undoubtedly done more than anything else to render gas lighting so popular. The improved light is forcibly brought home to us when we reflect that little more than a decade ago we were satisfied with an efficiency of 2·5 candles per cubic foot of gas with the flat-flame burner, and 3 candles per cubic foot with the argand; while with the better class of incandescent burner now in use, 20 candles per cubic foot is a common result, and with some of the inverted gas-burners, even better results are frequently obtained.

Against this great economy, must be set the cost of mantles and chimneys—a serious matter in the early days, but now a mere detail, since both chimneys and mantles have been so materially improved in quality, while the price has correspondingly decreased during the past few years. The greenish hue given off by the mantle in its infancy has now been eliminated; its luminosity has greatly increased; and it is now made much stronger, so that quite a common occurrence is for one to last from six to twelve months, and in places where there is little vibration and draught they have been used as long as two years. My experience has been that the stronger mantles have usually lost their brilliance sooner than those of a more fragile nature. An ideal mantle is one that unites both strength and a lasting brilliance. The "Laddite" mantle approaches very near this; for while being one of the strongest on the market, it retains its luminosity for many months. The Welsbach Company and some other makers of the better-class mantles now give guarantees with their mantles for periods of one to three months.

With incandescent lighting, vibration, draught, and dust are the chief things to avoid. The old-fashioned cork slide pendant, however suitable for flat-flame burners, has far too much vibration to be a suitable pendant for incandescent lights. All pendants for incandescent lighting should have a ball joint, or some other anti-vibratory device.

Inverted Burners.—The inverted burner from an æsthetic point of view is one of the triumphs of modern gas lighting. Previous to its introduction, our "electric friends" frequently crowed over us with regard to the artistic nature and absence of shadow of their fittings compared with ours. With inverted burners and some of the very artistic fittings now made, we can certainly hold our own with them in this respect; while from an economic point of view they are not in the running. The pneumatic and other distance lighters have also placed gas on an equality with electricity for convenience with regard to controlling the lights.

Prepayment Meters.—The economy effected by the popular use of the incandescent gas-burner would have been felt far more seriously by gas undertakings had it not have been for the almost simultaneous introduction of the prepayment meter. This system has been the means of bringing gas into the home of thousands of people who would otherwise have been debarred from its advantages. The remarkable popularity of the system is shown by the fact that one company alone have upwards of 200,000 slot meters in use, and that throughout the land gas undertakings have mostly adopted the system until it is exceptional to find one without it.

Gas-Cookers.—The large number of gas-cookers at present in use, and their growing popularity, are sufficient testimony to their usefulness. But it is important that the supply-pipe should be sufficiently large to meet the demands made upon it. The only objection to the gas-cooker seems to be that the hot-water supply cannot be maintained without keeping the fire in the kitchen range. This difficulty has, however, now been overcome. One of the most interesting appliances at the Manchester Gas Exhibition was shown by the Richmond Gas Stove and Meter Company, and consisted of their "Neptune" water-heater, fitted up just as it would be in a house to the existing hot-water pipes. With this apparatus, hot water can be had at any time. As much as 30 gallons of hot water can be obtained in an hour. The heater is fitted with a duplex burner, so that for ordinary use the small burner only (consuming about 8 feet per hour) is employed; this being sufficient to heat 50 gallons of water per day, at a cost of 3d. to 3½d. Gas managers and others will be wise in pushing an article which is so useful, and, while giving value for money, will help to increase the sale of gas.

Heating Stoves.—One has only to use a gas-fire properly fitted to realize what a boon it is. I say "properly fitted," because it is most important that they should be thus fixed, if they are to be a success. All gas-fires, whether self-contained or fixed in the grate, should have a flue to carry off the products of combustion whenever they are placed in living rooms. If the chimney has a bad or a down draught, it may be necessary to carry the flue-pipe a few feet up the chimney with a cone or hood on the top. This will generally overcome the difficulty. Condensing stoves and radiators are very useful for draughty passages or halls, where there is plenty of ventilation; but they should not be used in closed apartments.

In conclusion, I may repeat the old saying "Example is better than precept," and recommend all those connected with the gas industry to use gas in their homes as far as possible for lighting, heating, and cooking. They will then derive from personal experience some of the best arguments in favour of the use of gas in private dwellings.

Discussion.

Mr. R. J. Rogers (Birmingham) said a large percentage of complaints received by a gas company were due, as the author had pointed out, either to the pipes being fitted too small in the first instance or to the faulty manner in which they were laid; and it was most important that those responsible for the fitting of these pipes should be made to realize the importance of choosing proper sizes and fitting them in a satisfactory manner. The fitter or inspector entrusted with the duty of advising builders should be possessed of an average amount of tact for dealing with the matter. Much of the "jerry" work existing in the gas-fitting business of the present day was due to a great extent to the cutting competition of the private gas-fitter; but he believed the standard of work generally as regarded carcassing was much better than was the case a few years ago. Builders were beginning to realize the folly of "scamped" work. Probably more complaints, especially as regarded incandescent burners, were due to the ignorance of consumers in the use and adjustment of burners. Many complaints he had recently investigated arose simply from dirty burners, or the need for a minor adjustment of the air or gas ways. This only showed the scope there was for gas suppliers to take up the maintenance system. Where maintenance was not in vogue, education of consumers in the use of burners should be seriously taken in hand. If gas undertakings were to meet the increasing competition of electric lighting, they must certainly see that their gas, when delivered on a consumer's premises, was used to the best advantage. As to the size of pipes, not many companies enjoyed the privilege of such a clause as had been obtained by the Corporation of Perth—giving them power to insist on pipes of a specified size being fitted to all new houses or where any renewals were made. No doubt gas suppliers were being driven to adopt this course, to put an end to the "jerry" work; but he believed there was a great difference of opinion as to the advisability of adopting such stringent regulations and of refusing to supply gas until the premises were fitted properly. He had seen an arrangement—Potterton's—like that referred to by the author for heating water; but he did not think it had been very largely taken up by gas consumers.

Mr. W. Lycett (Birmingham) thought that the making of an allowance to builders, as suggested by the author, would only encourage the "jerry" builder. As far as his experience went, architects had always been most willing to adopt useful advice. Gas authorities would do better to fix meters and services as cheaply as possible, and leave the work which came within the province of the architect, who should, when getting out plans and specifications, see that the pipes were of a suitable size. Architects should be furnished with particulars of what the proper sizes were for pipes. Heaters, cookers, and other appliances should be hired out at as low a rental as possible consistent with the cost. There should not then be any jealousy with private traders; but if gas authorities began to assist in inside work, an agitation would start at once. He did not see why gas companies should not advertise.

Mr. R. S. Ramsden (Burton-on-Trent) inquired whether the system advocated, of allowing a commission or some concession on the proper fitting up of houses, was in practice anywhere? With regard to the work done by local traders, a system they had in operation at Burton answered very well. They announced on their gas bills, and the tradesmen advertised in their shop windows, that any gas-fire or stove—and great latitude was allowed in the interpretation of the term, such things as geysers or laboratory apparatus being included—purchased in the town would be fixed at the expense of the Corporation. A person went to a shop and bought a fire; and the fitter fixed it—sending the bill to the Corporation, who checked all times as far as possible. During the last twelve months, they had allowed them to have a share of the cooking-stove business as well. They had one or two stoves on exhibition in their shops; and the Corporation allowed them a commission of one or two quarters' rental if they got an order for these stoves.

Dr. W. B. Davidson (Birmingham) said that as to testing for leakages, he could not quite agree with Mr. Cadwallader's remark that the plan of watching the wheel above the meter-index was not a good one. How could they tell exactly what their leakage was unless they measured the amount of gas that leaked through? With the pressure-gauge, it was very indefinite. He mentioned five minutes in one case and fifteen minutes in another; but without the capacity of the pipes, they could not say what the leakage was. When looking at the wheel—of course, it had to be watched a considerable time—they would shut off all outlets and take a reading to the nearest part of a cubic foot; and after three or four hours, a reading would be taken again, when the amount of leakage in the interval would be ascertained. He would say that if it was more than ½ cubic foot in four hours, the leakage was considerable, and required attention. He had had a case of several leaks; and he could in this way tell after each one was attended to what the diminution in the leakage was, when the fitter could give him no information by means of a pressure-gauge. He would suggest that, before the meter was fixed, or preferably before the pipes were covered with plaster, they should be carefully and severely tested, not with a pressure of 2 or 3 inches, but of 40 or 50 inches. There was no reason why the fittings should not stand a pressure of 40 or 50 inches. It was a very important matter to see that fittings were not leaking, because it diminished the prestige of gas when leaks were in awkward parts of a house—say, under floors—and were only discovered after a considerable time.

Mr. W. GIBBS (Birmingham) also agreed with the importance of seeing that proper sized pipes were used. A good supply of gas was wanted for inverted burners; and he was sorry to say that some of the manufacturers had been cutting the fittings down so small for the sake of artistic effect, that the gas-way had been rendered insufficient. This, however, was being improved now. He thought water-heating appliances should be taken up very strongly. One or two had been fixed in Birmingham with satisfactory results. He believed the arrangement was Messrs. Wilsons and Mathiesons. So far from making any further concession in regard to laying services, he considered too much was being done now. With good-class buildings there was no trouble, as architects now insisted on good-sized pipes.

Mr. O. EVANS (Wrexham) said his Company adopted in 1905 a clause of the same nature as that of Perth which had been referred to. It was found to work very well.

Mr. J. HEWETT remarked that the author said that in fitting up houses laying service-pipes under the rooms of a house should be condemned. This, of course, did not refer to overhead rooms. While agreeing with Mr. Rogers's suggestion to undertake the regulation of burners, he should go further, and include periodical cleaning. The increase of light after a good cleaning was very noticeable—he should say the light at times was doubled. He certainly preferred to use the small wheel above the index when testing for soundness. In the case of a leaking main cock at the meter, the water gauge might remain constant, although the pipes and fittings were unsound. Considering the longer life of inverted mantles compared with others, could Mr. Cadwallader say if mantles with bayonet joints had been used on ordinary burners, and so dispense with the prop?

The PRESIDENT (Mr. W. E. Caton, Derby) agreed with the necessity of maintaining consumers' burners in a proper condition, as they were one of the chief causes of complaint now that naphthalene stoppages were practically overcome. He believed the best way was for the gas suppliers to maintain the burners. He did not agree with what the author said of "Laddite" mantles. He proposed a hearty vote of thanks to Mr. Cadwallader.

Mr. J. H. WILLOUGHBY (Leamington) seconded, and pointed out that the "Neptune" water-heater required an expenditure of gas; whereas there were means by which hot water could be obtained from waste heat. The Imperial Stove Company had such an apparatus. As to testing, he was surprised no mention had been made of Thorp's indicator, which was very reliable. There was not the least doubt that nowadays gas companies must advertise and canvass.

Mr. CADWALLADER returned thanks for the vote, and said he agreed that dirty burners were a great source of complaint. Many people did not know how to clean them. More often than not it was the gauze that was dirty; and for cleaning this he generally used a wire brush. Maintenance by gas companies was the most satisfactory way of overcoming this and other difficulties with incandescent burners. The only water-heater he had seen personally was the "Neptune," which seemed a very good thing. The heating of water from waste heat did not appear as though it would be sufficient to meet the requirements of a moderate sized house. As Mr. Lycett said, architects were now putting in good pipes; but unfortunately there were thousands of builders who did not trouble architects for anything if they could help it. Those people who did not have an architect to assist them in erecting their property were, he thought, just the ones who would listen to a gas undertaking offering such a concession as he was advocating. More harm than good might, in his opinion, be done by forcing a large sized pipe on people. It was better, if possible, to persuade them to use the right sizes. With regard to advertising, the outside gas-fitters in Birmingham had carried on a good deal about the Gas Department; and one of the points made by the Department was that they did not advertise, while the gas-fitter could do so as much as he liked. As to Mr. Ramsden's inquiry, he did not know of any place where such a scheme as was suggested in his paper had been put into operation. With the automatic installations at Birmingham, they now allowed a special price for the first 12 feet of private service; and they found this a great inducement to builders and others to have the houses fitted up properly. They made it a condition that they must have at least ½-inch pipe running right through the premises. He thought if the idea was extended to the ordinary consumers as well, it would probably be beneficial. The water-heaters he had inquired about had given good results. He referred in his paper to the use of the pressure-gauge for testing for soundness—not for judging accurately the extent of an escape. He was alluding to the case of a man, after fixing fittings, going down and looking for five minutes at the meter-wheel. With the pressure-gauge one could tell at once if there was a serious escape—certainly, one could tell ten times as quickly with the gauge as by the meter-wheel. Of course, for ascertaining the extent of an escape the small wheel was a very reliable guide. In olden days, gas-fittings were very ponderous; but now they were made as thin as possible, and it did not take a great deal of condensation to stop up some of them. As to services under floors, he was alluding to the laying of them under (say) a front living-room on the ground floor to the back of the premises. Now the rule with the Department was to enter such buildings above the floor level. He had had a "Laddite" mantle in use for several months on a "Surprise" pendant; and it had stood the vibration far better than any other sort he had tried. Thorp's leak indicater he thought was more for mains.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

The Eastern District of the Scottish Junior Gas Association paid a visit on Saturday afternoon to the Perth Corporation Gas Works. The city being easily accessible to a large proportion of the members, there was an attendance of about thirty, which was very gratifying. At the works, they were received by Mr. W. B. M'Lusky, the Manager, and Mr. R. Hamilton, the Convener of the Gas Committee. Mr. M'Lusky conveyed to the visitors the regret of Lord Provost Cuthbert—a former Convener—at his inability to be present. Parties were made up; and the inspection of the works was carried through in the waning light of a dull winter day.

Visiting the retort-house and coal-store first, it was found that coal is brought in by two high-level railways; one 10 feet above the floor of the store, and the other beginning at a level 3 feet higher, and rising very rapidly—the gradient being utilized for shunting purposes. In the western or older part of the house, there is a coal-breaker, which deals with the larger coal—only about 10 per cent. of the whole—and it is then carried by a West elevator to an overhead hopper of 80 tons capacity. In the eastern or newer portion of the house, the floor is tunnelled, and the coal is elevated in hutches, by means of a hydraulic hoist, to an overhead railway, where it is distributed to the hoppers as required. There are two retort-benches, on end; the one which was erected when the works were constructed containing seven through beds of eights, 21 ft. by 22 in. by 16 in. These are fired by producers at each end. During the past year, two of the beds have been converted into nines, with satisfactory results—the same system of firing being retained. The second portion of the bench contains the same number of ovens; but only three of these have as yet been filled. West's manual charging and drawing machinery is used in connection with both benches. The excellent working of the plant was well exemplified by the perfectly level laying of the coal, and the thorough manner in which when discharged it was shown to be carbonized. On being drawn, the coke is quenched in chambers before being dropped into hutches, which run to the hydraulic elevator, from whence they are, at a high level, run to a double-action jigger screen, which sorts it into three sizes, and delivers it into waggons or carts; or it can be sent to the yard for storage, for which purpose there are two gantrys, also served by the hydraulic elevator. The yard is tunnelled, for the withdrawl of coke from the bing; the course being through the elevator to the screening plant. The retorts are charged five times in 24 hours.

Upon the retort-benches there are three governors, the advantage of using which was seen in the fact that there was not a vestige of carbon in any of the retorts that were opened; and Mr. M'Lusky explained that there never is any now. The gauges in the retort-house are fitted with the air-cushion, which was the invention of Mr. Thomas Whimster, a distinguished former Manager of the works, whom many will be pleased to learn is still a hale and hearty citizen, living in retirement. The intention of the air-cushion is to prevent the gas from touching the water in the gauges; and its efficacy was seen in the fact that some of the gauge-glasses have not required to be cleaned for eight years. There are also gauges on the dip-pipes, with portable grease-sockets. The tar is taken up by Dillamore columns. There are two batteries of condensers, one atmospheric, which was first erected, and the other annular, which has been added. At the inlet to the condensers apparatus has been placed by means of which Pintsch oil-gas tar is volatilized by a carburettor, which carburets the air used for revivification purposes, and also acts as a solvent to prevent deposits of naphthalene.

From the condenser, the gas passes through a Livesey washer and a Holmes scrubber-washer, and thence to the purifiers, which consist or four boxes, 25 feet square, and four, in line, 30 feet by 25 feet. Both lime and oxide of iron are used. Revivification *in situ* is practised, a feature of which is that when the oxide is showing foul, a lime-box is put on, in its series; and this, in a few hours, cleanses the oxide. At the station-meter outlet there is fixed a Livesey washer, charged with Pintsch oil-gas tar, by means of which the deposition of naphthalene is prevented—a gallon of tar being sufficient to deal with the gas from 10 tons of coal. The bye-products are worked up; the sulphate plant consisting of a Wilton still with a Taylor heavy plate-lead saturator, and the tar being distilled—it is the only gas-works in Scotland where this is done—by R. & J. Dempster's high stack stills, gaseous fired. It is found that there is a good local demand for the resultant pitch, and that the oils can be readily disposed of for lubricating purposes.

On the conclusion of the inspection tea was served, after which Mr. R. Hamilton, the Convener, in the name of the Gas Commissioners, extended a hearty welcome to the visitors, and hoped they had benefited by the visit. Mr. D. Bisset, the President of the Association, said that he was sure he voiced the feeling of every member who was present that afternoon when he said they had spent both a pleasant and a profitable time in the Perth Gas-Works. They derived great benefit from such visits, because it afforded them the privilege of seeing how, in different gas-works, they faced the problems of producing, purifying, and distributing gas to the consumers. Not only did Mr. M'Lusky make the gas and distribute it, but he also dealt with the bye-products in an exhaustive way. He worked up the ammoniacal

liquor into very valuable sulphate of ammonia; but he went farther, and distilled tar. They had all been impressed with the up-to-date condition of the works. He proposed a very hearty vote of thanks to the Corporation of Perth for throwing their works open to them, to the Convener, and also to Mr. M'Lusky's assistants, who had done their utmost to make the visit a pleasant and profitable one.

Mr. M'Lusky said he had been trying to impress upon his assistants the valuable work which the Junior Associations were doing. Recently he had been comparing the work of the Junior Associations with that of the Senior Associations, to the disadvantage of the latter in many respects; and he had been showing to his assistants that the work of the juniors was making a short-cut to success. In the earlier days they had not only to learn their business, but they had to devise the means and conceive the methods of acquiring the knowledge, and gaining the experience, which was necessary for the carrying on of their work; and they had not the help which the juniors had now-a-days in equipping themselves for their work. He was afraid that some of them went out to responsible duties deficient, in many respects, as compared with the juniors of to-day. The preparation which they now had should make them more proficient, and more efficient, as managers, for several reasons. In the first place, they had the road pointed to them; and in the next, they had these meetings, in which the man of strong commercial instincts, and the man of great native engineering ability, met and compared matters, thereby helping each other. These things were an educative force in the gas profession.

On their way back to the town, the party visited the gasholder station on the South Inch, and were delighted to see the most complete governor-house from which the gas supply to the three districts into which the area is divided is regulated.

THE LIGHTING OF WORKROOMS.

A paper upon various physiological and physical aspects of artificial light was read by Dr. F. Schanz, an oculist, and Dr. K. Stockhausen, an engineer, of Dresden, before one of the sections of the German Association of "Naturforscher und Aerzte" which was held a short time ago.

According to an abstract of the communication which has appeared in the "Journal für Gasbeleuchtung," Dr. Schanz described a severe case of electric ophthalmia ("Ophthalmia electrica") which had recently come under his notice, and was caused by undue exposure to the ultra-violet rays of the light. Dr. Schanz remarked that many authorities considered glass such as was used in the manufacture of globes or spectacle lenses to absorb the ultra-violet rays; but, as a matter of fact, it only absorbed those rays which had a shorter wave length than about 300 $\mu\mu$. Ultra-violet rays of such short lengths possessed the lowest degree of penetrating power, and therefore affected the human body to the smallest extent. Harm was chiefly done by rays having wave lengths between 400 and 300 $\mu\mu$, which passed through glass without absorption. Blue glass, indeed, frequently employed in the construction of spectacles for protective purposes, was particularly translucent to these rays; but smoked glass absorbed them to a considerable extent. Dr. Schanz went on to describe experiments carried out by Dr. Stockhausen and himself upon the amount of ultra-violet light present in ordinary artificial illuminants. After examining every source of artificial light from the pine torch or "fire stick" of the ancients to the most modern form of electric lamp, they found that the proportion of ultra-violet light grew with the intensity and with the rise in temperature of the unit. Although many persons had complained of the effect produced on the eyes by the rays, few attempts had been made by engineers to eliminate them from the lights used for domestic purposes. Dr. Schanz proceeded to sketch the pathological results of prolonged exposure to light containing ultra-violet rays, suggesting that the degradation of the human lenses with advancing years was caused by the fluorescence in those organs established by entry of ultra-violet rays.

In the second part of the communication, which was presented by Dr. Stockhausen, the author emphasized the necessity of distinguishing between the effect of the visible and the invisible rays of light upon the eye. The dazzling effect of an intense lighting unit increased with its specific intensity and its superficial area. The highest specific intensity which the eye could bear without injury was one equal to 0·75 hefner per square centimetre—*i.e.*, 4·4-candle power per square inch. In the course of their investigation of light sources already mentioned, they had found that only the pine torch, the candle, the open rape-oil lamp, the flat-wick paraffin lamp, and the flat-flame gas-burner exhibited specific intensities below that maximum. The ordinary round wick petroleum lamp had an intensity 5 times the limit quoted. The intensity of the incandesent coal-gas burner was 8 times, that of the carbon filament electric glow lamp was 100 times, that of the metallic filament electric glow lamp was some 270 times, that of the Nernst lamp was some 550 times, and that of the arc was some 4000 times greater than the limit given. The intensity of the inverted incandescent gas-burner was somewhat higher than that of the upturned burner, and was about equal to the intrinsic brilliancy of the open acetylene flame. The intensity of a Nernst lamp was 2700-candle power per square inch.

It was therefore necessary that every source of light except the candle should be surrounded by a dispersive globe when the light was required for reading or working. Unfortunately, many globes were defective, containing patches of excessive translucency through which rays of two or three times the proper brilliancy passed. The severe competition between gas and electricity had caused attempts to be made to attain the maximum illumination for less than the proper outlay; economy being sought by the use of transparent globes round the light. Even when shades were used, they were generally employed only to reflect the light downwards so as to obtain a more intense illumination of the working surface without causing efficient dispersion of the rays. The author therefore submitted the five following propositions as requirements for the satisfactory illumination of workrooms: (1) All sources of light must be surrounded by dispersing globes in such fashion that the rays of light reaching the eye do not possess a higher specific intensity than 4·4-candle power per square inch. (2) The chimneys or shades must be constructed of such glass as absorbs the ultra-violet rays. (3) The shades must be of such thickness and shape as wholly to enclose the light source and to form a luminous surface of uniform emissive power. (4) Glow lamps enclosed in plain glass bulbs must not be employed in workshops and schoolrooms. (5) Indirect illumination is the best system of all to employ.

Manchester and District Junior Gas Association.

On the invitation of Mr. S. R. Ogden, the Engineer and Manager of the Blackburn Gas-Works, a visit was paid to the Greenbank station on Saturday by the President (Mr. E. J. Wellens) and the members of the Association, for the purpose of inspecting eleven beds of inclined retorts (eights), with coal and coke handling plant, tar extractor, washer, scrubber, battery of condensers, and an example of the use of reinforced concrete in the construction of a water-tank and coke-hoppers. There was a large attendance of members; and on reaching the works the President introduced them to Mr. Ogden. The party then divided into two sections—one being conducted by Mr. Ogden, and the other by Mr. Harold Davies, the Assistant Gas Engineer to the Blackburn Corporation. Each party made a tour through the extensive buildings which form the Greenbank Gas-Works. All the processes in operation were seen, and a careful inspection was made of the machinery and plant. Interest, however, centred chiefly in the reinforced concrete hoppers and water-tank, with inclined coke-elevator, which had cost £850. The capacity of the tank is 150 tons of water, and that of the hoppers 200 odd tons of coke. At the close of the inspection, the members took tea together at the White Bull Hotel—Mr. Wellens in the chair. After the repast, Mr. Davies read a paper on "Some Uses for Reinforced Concrete in Gas-Works," which was illustrated by numerous plans and photographs. The paper, with a report of the remarks to which it gave rise, is unavoidably held over till next week.

The Late Mr. John Coppen.—At the annual general meeting of the Staines and Egham District Gas Company, Limited, last Tuesday, the proceedings were commenced by the passing unanimously of a resolution expressing the great regret of the meeting at the loss sustained by the death, on the 20th ult., of Mr. John Coppen, the late Chairman of the Company, and conveying to his widow and her family an expression of sincere condolence and sympathy. In moving this resolution, the present Chairman (Mr. Herbert Weller, J.P.) stated that the Directors had already passed and put on record a similar resolution expressing their personal loss, as they missed the deceased, not only as an able and energetic Chairman, but also as a colleague who, by his courtesy and geniality, extended to them over a period of eleven years of constant business connection, had earned the esteem and respect of them all. He was sure the shareholders would recognize that they possessed in their late Chairman a man of unique experience and knowledge of the gas-making industry, and one who made many friends.

Gas and Electric Light in Fog.—It is always interesting to read independent testimony in favour of gas, and therefore we reproduce the following remarks by Mr. J. Ashby-Sterry ("The Bystander") in a recent number of the "Graphic": "It is strange to find what an utter failure the electric light is in foggy weather. We expected so much of it. We thought its rays would pierce the thick brumous atmosphere, and render comparatively harmless that gloomy pall which is apt to descend upon London at this time of the year. Alas! and alas! we are grievously disappointed. Looking from the window where I am now writing, and gazing upon a dense fog, I see a very powerful electric light, and at its foot is a gas-flare. The first seems to have no penetrating power whatever, and looks like a white pin-point in the midst of dismal gloom. It illuminates nothing, and is absolutely lost in the density of the surrounding fog. The second appears to possess an extraordinary power over the clouded atmosphere. It not only makes its own light visible from a distance, but its rays seem to have the faculty of piercing and dissipating the density of the 'London particular,' and diffusing a light and a geniality all around. Of late years, gas has been roundly abused; but its use in a thick fog cannot be too well appreciated."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Coalite.

SIR,—I hesitate to trespass further on your space, especially as I am still waiting for Mr. Marshall's reply to the points raised in my first letter. I can quite understand his being angry with me; but hard knocks do no harm, unless they waste your space. And surely he does not expect the extravagant claims he advanced on behalf of coalite to go unchallenged. Mr. Marshall talked of "calmly discussing the process;" and this can be done while still permitting criticism. But we cannot all be champions of the process, or there would be no discussion.

But, Sir, the recent action of the Coalite Company seems to me the weightiest criticism we could have against the process as a venture holding out any reasonable prospect of financial success. We were told that the process was primarily for the production of a smokeless fuel; but now it is revealed as a gas-making process, requiring all the privileges and protection accorded by Parliament to gas-works to make it a succees. And yet the gas people, who should be the best judges, will have none of it; and so the promoters must find a power market for their rich gas. A forlorn hope, surely!

Even now, do the promoters know what they can do in the shape of gas or coke or bye-products, or is it still the subject of experiment over old ground and further patents?

Mr. Parker's own words—see "JOURNAL" for Dec. 3, p. 715, patent specification—are almost pathetic in the despair and hope-deferred which can be read between the lines. He has found, after all, that it is "impossible to produce a partially-coked fuel of uniform character and homogeneity," and the caking of the surface "prevents the outlet of the gas from within the fuel."

The temperature discovery loses its early importance. It may not now be rigidly adhered to; but the heat must be gradually and slowly applied, indefinitely, according apparently to either pyrometer readings or flame tests. Are the workmen to be chemists or stokers? And would it not be as well in the interests of the shareholders to spend money on a laboratory and let the works wait awhile?

It is a pity Mr. Parker has allowed himself to be "rushed" by the promoters into a position which I am sure must now be giving him no little concern for the shareholders as well as for himself.

Mr. Marshall, in his first letter, claimed huge profits from the bye-products; and I challenged his figures. In his reply he merely states that they can be upheld; and yet, in the next breath almost, he admits—replying to "J. D. B."—that it is a question whether coalite "can be produced without an extravagant cost of fuel, labour, and maintenance. He is not consistent.

Can Mr. Marshall give us any figures as to the costs? Are they known? Or are the Company stepping straight from a small experimental plant of one or two retorts to an installation of 1400 tons of coal per day, without knowing the costs?

Is the benzol produced from this process a benzol at all? All chemists know that at the temperatures Mr. Parker seems to be claiming a patent for, hydrocarbons of the paraffin series are produced—see Dr. Colman's lecture, *ante*, p. 633: "We have seen that while the coal is only at a low temperature during the process of heating, it is giving off petroleum-like hydrocarbons *which are useless to the gas maker*." Mr. Marshall claims a value of 2d. per gallon, or (say) 35s. per ton, for the coalite tar. Your market report for this week is 13s. 6d. to 17s. 6d.! What wonderful constituents does it contain to double its value?

As to coalite itself. It is certain this soft coke will not stand stocking in the open without depreciation; and seeing that 14 per cent. of the volatile constituents of the coal are left in, will not the sulphur percentage be much higher than in gas-works coke?

Perhaps Mr. Marshall will give us an answer to these questions, in spite of the discouraging attitude of the Technical Press, with which attitude he is good enough to associate me. Mr. Marshall must not mistake criticism for prejudice.

Dec. 9, 1907. M.INST.C.E.

Mr. Dugald Clerk on Gas-Heating Apparatus.

SIR,—I was much interested in Mr. H. James Yates's instructive letter in the "JOURNAL" for the 3rd inst., respecting Mr. Dugald Clerk's address to the Society of British Gas Industries. I heartily agree with Mr. Yates when he emphasizes the necessity for up-to-dateness in any criticism of gas-stoves or other goods, which are as perfect as modern science and experience can make them; and I was surprised that the comments on Mr. Clerk's address at the meeting referred to should have proved in the main a direct attack on stove manufacturers.

I had hoped that some speaker would have touched upon another important factor in gas heating, but was disappointed; and that is my reason for entering the field now. I refer to the subject of gas pressure; and I would suggest that every gas engineer, distributing engineer, or other official responsible for the control of gas supply, should decide, once for all, what the minimum pressure should be during each 24 hours. It is not sufficient nowadays to give night pressure only; indeed, I think it would be preferable that a uniform pressure (whether 2 inches or 4 inches) should be maintained throughout the 24 hours, rather than have 2 inches during the daytime and 4 inches during what are termed the lighting hours.

I would also ask these same officials to see that their gas is not only up to the candle standard (that being of comparatively little moment in modern times), but that the quality should be equal all round and consistent in its proportions all the time.

A ready reply to these proposals will be that such things are more easily talked about than accomplished; but I have no hesitation in contending that they are more practicable in a great measure than that which is being demanded from the stove manufacturers, and would materially assist the latter in securing satisfactory results.

The matter of pressure and quality is one which is of the utmost importance both in this respect and in connection with lighting; and it is one which must receive serious consideration if inverted gas-fittings (now so popular) are to hold their own against the electric light.

The progress of electric lighting has undoubtedly been retarded in the past through insufficient voltage—hence want of power per unit. Gas lighting is seriously handicapped for the same reason—lack of regular pressure and consistent quality; hence lack of power per cubic foot.

Leeds, Dec. 9, 1907. WILLIAM D. HELPS.

The Alleged "Breakdown" at Aberavon.

SIR,—The paragraph in the "South Wales Daily News," quoted in the last number of the "JOURNAL," and referring to the new gas-works at Aberavon, is altogether misleading; and, in justice to the contractors and ourselves, an explanation is necessary. There are no "defects" in the new works, and there was no breakdown. Two ovens at the old works were put under fire as a matter of precaution, and to guard against any shortage in the supply until such time as the men have become familiar with the working of the regenerative furnaces. One half of the house is still to be filled with retorts.

Manchester, Dec. 12, 1907. THOMAS NEWBIGGING AND SON.

Dessau Vertical Retort Trials: A Correction.—Writing in reference to the table giving the results of trials made in Dessau, with 4-metre retorts, by the Engineers of the Continental Union Gas Company, forwarded to us by Herr E. Körting, and embodied in an article in the last number of the "JOURNAL" (p. 765), he says: I now perceive that a clerical error occurred in the "Remark." This should read: "Gas corrected to 29·922 inches barometer and 59° Fahr.—not mm. and Celsius."

The Geltsdale Water Arbitration.

The Carlisle Town Council discussed at their meeting last Tuesday, on the accounts submitted by the Finance Committee, the sum to be paid to Lord Carlisle in accordance with the Umpire's award (*ante*, pp. 274, 585) in the recent arbitration proceedings. Mr. Crowder said it must be clear to everyone that it would be running a grave risk to contest the supplementary award of the Umpire, after the advice of Counsel. It was impossible, however, to get rid of the fact that Lord Carlisle's original claim was to sell the water at so much per 1000 gallons; and that it was only after the decision that there was no property in water that the basis of the claim was shifted to two points—first, the loss of value in the area; and, secondly, its adaptability as a reservoir site to some hypothetical purchaser. On the first, there might be some difference of opinion; but it seemed probable, according to Counsel, that the Umpire, if asked again, would recast his award in such a form as to show the same result as regarded the Corporation. In return for the large amount of compensation, amounting to £18,000, with interest at 5 per cent. for three years, £2482, and the Umpire's fee, &c., making an aggregate of £21,502, they had acquired a property of something under 7 acres, with certain easements. It seemed a bad return for the money; but it was the fortune of war, and he could see no other way than to pay. Mr. Wardle, in supporting the motion for the adoption of the minutes of the Committee, said a great injustice had been perpetrated upon the city and people of Carlisle; but he felt they had no alternative but to pay and look pleasant. Mr. Collin thought the Council did not go about the scheme as they ought to have done. The whole business was carried out in a blindfold way. The Mayor (Mr. W. N. Donald) said he was sorry they could not continue the action with regard to this extortionate overcharge; but, in the circumstances, it might be best to pay the money and forget it. The minutes were then adopted.

Torpoint Water Supply.

The difficulty over the water supply of Torpoint, which has proved a source of trouble and expense for several years, seems at last in a fair way of settlement. Some years ago the Torpoint District Council went to Parliament with an ambitious scheme, supported by the Admiralty, who then contemplated building in the neighbourhood. Unfortunately for Torpoint, a change in Admiralty policy took place while the Bill was under consideration; and the Government support being withdrawn, the Parliamentary Committee promptly rejected the scheme. Several other proposals have since been reported upon, considered, and dismissed. In the meantime, General Sir R. Pole Carew, the local landowner, has been seeking a supply for his own residence, Antony House, which is only a mile or two from Torpoint; and in solving this problem, he appears to have overcome the difficulty experienced by Torpoint itself. In searching for water in the hills at Higher Tregantle, good springs of water which seem to have been flowing seaward have been struck. At present the supply is about 80,000 gallons a day; but it is intended to drive a tunnel into the hill, and it is anticipated that the effect will be to materially increase the quantity of water available. In any case, there will be a considerable amount available for the augmentation of the Torpoint water supply; and it will be at a level which will meet the needs of the higher parts of the town, which are now inadequately supplied. Mr. J. Gilbert, the Agent to Sir R. Pole Carew, met the members of the Torpoint Council last Wednesday, and went with them over the works which are being carried out under his supervision. He expressed the opinion that the yield would be 100,000 gallons when the excavations had been carried farther, about Lady Day next, and said that Torpoint might have the supply it required at the cost of 4d. per 1000 gallons up to 20,000 gallons per day; the price for any quantity beyond this to be 2d. per 1000 gallons. For the present, at all events, it would only be necessary for the District Council to lay a main to Antony, a distance of a little over a mile. The members of the Council expressed themselves gratified with the evidence they had seen of the quantity of water available, and they will probably come to an agreement with Sir R. Pole Carew on the terms indicated.

REGISTER OF PATENTS.

Coin-Freed Apparatus for the Supply of Water.

LIESSMANN, G., of Königsberg, Germany.

No. 19,702; Dec. 4, 1906.

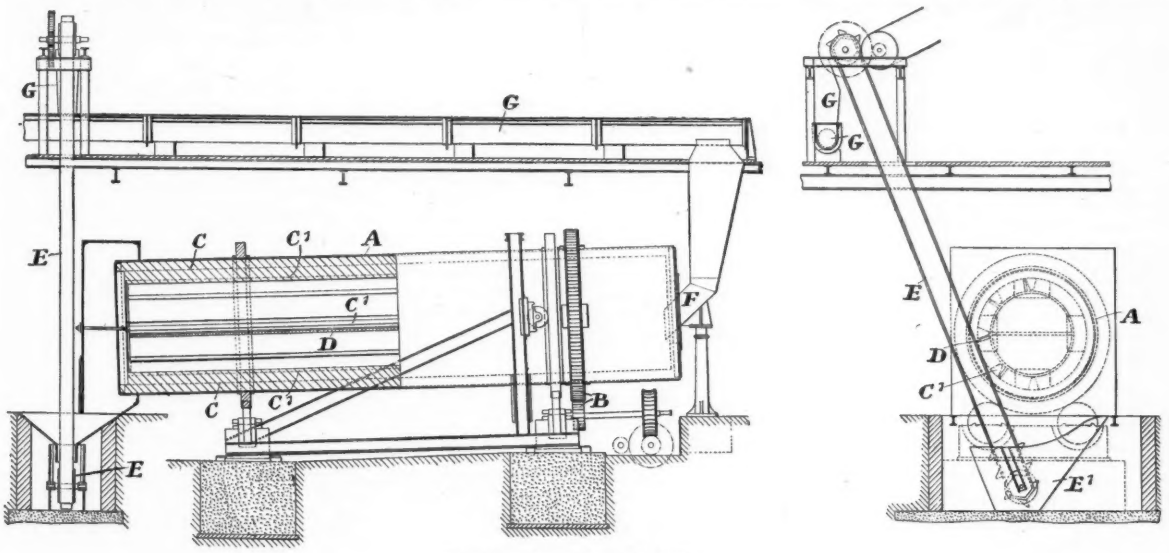
This coin-freed apparatus for the supply of water is so arranged that the opening and closing of the inlet and outlet valves is effected through the medium of cranks by one turn of the handle in such a manner that the opening of the outlet valve happens after about half-a-turn of the handle (which is prevented from returning by an arresting device) after an arrangement for the automatic completion of the full turn of the handle directly upon liberating the latter, is put in action.

Revivifying Oxide of Iron.

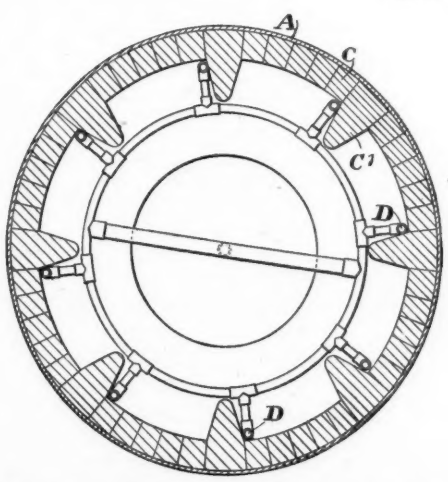
GLOVER, S., of St. Helens, and GLOVER, T., of Norwich.

No. 26,039; Nov. 17, 1906.

This invention, relating to apparatus for revivifying oxide of iron as used in the purification of gas, is of the kind in which the oxide is subjected to the action of air and vapour while caused to fall through a revolving drum like that commonly employed in drying or treating



Glover's Oxide of Iron Revivifier.



other granular substances, and through which the oxide is fed continuously or in batches.

The arrangement was referred to in the "JOURNAL" for Nov. 27, 1906, p. 603, on the occasion of the meeting of the Manchester District Institution of Gas Engineers at Salford.

As shown, the revolving drum A (of the ordinary form) is supported at a slight inclination from the horizontal and driven by toothed gearing B. But, in order to prevent oxidation of the iron of which it is composed, it is lined with bricks or blocks C; and to provide for lifting the oxide and dropping it in streams as the drum revolves, inwardly projecting blocks C^1 are fitted at intervals between the lining blocks. The sides extending inwardly beyond the lining serve to raise the oxide and drop it again in streams; "the oxide being thus not only caused to fall in a succession of streams, but to turn over on itself, and to continuously expose fresh services to the action of the air and steam during its passage through the vessel." The steam and air are preferably delivered into the falling streams of oxide by pipes D extending along the bases of the projecting blocks.

The object of the arrangement is to treat the oxide to be revivified in batches, to make the treatment of each batch practically automatic, and to shorten the period of time required for restoring the foul material into a condition fit for use again. To do this the cylinder is fed by an elevator E, from a hopper E^1 at the discharging end, into which the batch of oxide to be treated is first tipped, and into which the oxide is discharged from the cylinder, to be returned again and again to the feeding end at F—for example, by an elevator E and inclined conveyor G—until revivification is completed. When the revivification of a batch is completed, the oxide falling from the discharging end is diverted into a second hopper, from which it is elevated or removed into the position where it will be required for use again.

The internal projections C^1 should, the patentees point out, be arranged screw-wise, and the flow of air regulated by steam-jet injectors. Also provision may be made for taking off the foul gases at the feeding end to a suitable elevation; and scrapers may be fitted inside the cylinder (suspended from a central shaft) to remove the oxide if it should have a tendency to cling to the sides.

Discharging Coke from, and Charging Coal into, Gas-Retorts.

FIDDES, W. W., of Bristol, and ALDRIDGE, J. G. W., of Victoria Street, Westminster.

No. 27,117; Nov. 28, 1906.

This invention has for its object to provide apparatus suitable for use with round and oval retorts, consisting in a stiff or jointed centre bar having swinging push-plates hinged to it, and corresponding to the shape of the retort; also a hinged or jointed table adapted to extend from the machine to the mouthpiece of the retort, and provided with curved sides so as to retain in position the coal as it is fed from a supply hopper and pushed into the retort by the swinging push-plates—the front push-plates serving also to discharge the coke.

In one way of carrying out this invention, a jointed bar is provided with push-plates hinged to cross-bars in the jointed bar and swivelling in sector-shaped holes in the cross-bar; the swinging plates being grooved at the bottom so as to extend beyond the bottom of the holes. The plates swing towards the front of the bar when it is withdrawn, so as to pass over the deposited coal. The table over which the bar passes into the retort is hinged to, or slides on, the charging apparatus, and has curved sides at the front or retort end; and the coal is projected from a supply hopper more or less into the interior of the retort as the bar is moved into the retort.

In a modification, the push-plates are in two halves, instead of swinging in sector-shaped holes in the centre bar; each half being firmly fixed to the cross-bar so as to lift as one plate. In this case, the apertures would not be required.

Removing Naphthalene from Gas.

GRAFTON, WALTER, of East Ham.

No. 27,908; Dec. 7, 1906.

Referring to the subject of his patent, the inventor points out that some success has followed the use of a suitable solvent or distillate of coal tar, as light creosote or heavy naphtha possessing an affinity for naphthalene ($C_{10}H_8$) through which the gas charged with $C_{10}H_8$ is caused to pass in the hope of removing all $C_{10}H_8$ "with but only partial success, and in some cases failure."

He, therefore, proposes using an early distillate of petroleum oil, or of oil carburetted water-gas tar—for preference, produced and resulting from the manufacture of 18 to 30 candle carburetted water-gas, and which upon distillation yields a solvent coming over under 390° Fahr., and having a specific gravity of about ·895 to ·917. Although as a true guide, he states, these figures are not wholly to be relied upon, because tars are extremely complex mixtures, whose unravelling has not been anything like completely accomplished, even in the best-known case, of coal tar, much less in other cases of distillates of oil, oil-gas tar, or carburetted water-gas tar.

Tar obtained from the same material differs very much in composition, according to the temperature of distillation and the kind or shape of retort, as well as the time occupied in the process of destructive distillation or cracking of the oil. The composition of the first runnings

varies very much—especially at the lower temperatures, without being indicated by the specific gravity. Thus the commercial value cannot safely be estimated by this test, because many substances and liquids have the same specific gravity, yet in themselves are wholly different and useless for the purposes of extracting $C_{10}H_8$.

The specification continues: The distillate I use is of a spirituous nature and rich in the light oils, having a great assimilation for, and solvent action on, naphthalene at moderately high temperatures—say, 160° Fahr., but at low temperatures allows the absorbed naphthalene to separate out and deposit in solid form, and consequently easy of removal. The solvent can be employed over and over again; it being simply used at one temperature to arrest the $C_{10}H_8$ in the vaporous form, and at another, but lower, temperature to deposit same, due to supersaturation of the solvent. From this it is clear that all that is needed is to maintain an elevated temperature until the solution becomes practically saturated with $C_{10}H_8$ (which may be 5 lbs. or more per gallon, according to the temperature) from the gas, and which can be indicated approximately by the specific gravity or any other known way. The solvent is then run out to cool; and the solid $C_{10}H_8$ separates out and falls to the bottom of the vessel, when it can be fished out on to a draining table or floor. The solvent has no detrimental effect upon illuminating gas, but a substantially beneficial one on the quality of the gas both as to its heating and lighting value.

To carry out the object of the invention, it is preferable and necessary to use a rotary scrubber wholly or in part, although a stationary one in which the gas passes through the solvent will answer. But the former can, should occasion require, form part of any existing washer-scrubber employed to remove other impurities, by using (say) two bays of the machine into which the solvent is placed to flow from one to the other bay as desired. When the scrubber is used for the double purpose, the separating division wall must be higher than will allow the solvent to mingle with the liquor content of the other bays. Through the side near the bottom of the bays steam is conveyed in pipes, which may pass out at the other side to escape or return through the next bay before discharging in the air or being otherwise used. Steam-valves regulate the heat necessary to elevate the temperature of the solvent to the desired degree. An equal temperature is obtained by the rotary action of the cylinder working in the bay, at the same time presenting warm solvent to the current of gas passing through the scrubber. If applied to the stationary apparatus, the bubbling of the gas through the solvent, coupled with such convection movements as exist, will assist in maintaining uniform temperatures, "although it may be desirable, beneficial, and economical to work with graduated temperatures from one end to the other of either of the types of apparatus employed, and so be independent of climatic changes."

Distillation and Partial Dehydrogenation of Hydrocarbons.

Société Anonyme des Combustibles Industriels, of Haine-St-Paul, Belgium.

No. 28,689; Dec. 15, 1906. Date claimed under International Convention, April 19, 1906.

In patent No. 16,182 of 1905 there is described a process of distilling and oxidizing hydrocarbons, wherein the hydrocarbons are distilled under conditions such that extraneous oxygen is fixed upon them—the fixation being in some cases even carried to such a point that fatty acids are formed. The method consisted shortly in preliminarily heating the hydrocarbons and then effecting or completing the distillation by passing through the hydrocarbons (*a*) a current of dehydrated and decarbonated air heated to a temperature approximating that of the hydrocarbon, or (*b*) a current of heated air with added oxygen, or (*c*) a current of air enriched with ozone. The distillation was completed by the heat exothermically generated in the mass by the oxidation of the distillation products. The object of the present invention is to provide a method of distilling and partially dehydrogenizing hydrocarbons—that is to say, a process wherein oxygen shall not be fixed upon the hydrocarbons, but these latter shall be distilled under conditions such that they will be partially dehydrogenized, by depriving them of hydrogen, which combines with the oxygen of the air employed, forming water.

The claims made by the patentee include: 1. A method of distilling and partially dehydrogenating hydrocarbons consisting in heating them to a suitable point, and thereafter, without applying fire heat, blowing through the mass cold air alone or enriched with oxygen, or equivalent oxidizing agent, or mixed with inert gases (such, for example, as carbonic acid, nitrogen, or poor gas, according to requirement) for the purpose of dehydrogenating and converting the hydrocarbon—the distillation being effected or completed without fire heat by the aid of the exothermic dehydrogenating reaction effected under the conditions mentioned. 2. In such a process cooling the mass in the still during the distillation and dehydrogenation. 3. The manufacture by the process specified of products having a more condensed molecular composition, and arising from the combination of the radicals liberated by the partial dehydrogenation of hydrocarbons in the manner described, whether the products distil off or remain as non-distilled residues—the molecular condensation effected varying according to the pressure which is exerted on the mass in the distilling apparatus. 4. The application of a process such as described, of distilling and partially dehydrogenizing without fire heat to mixtures of hydrocarbons capable of modification by the process with other bodies which do not undergo dehydrogenation therein—the modified hydrocarbons supplying the necessary heat units for the distillation of the unaltered bodies.

As an example of the process suggested, the inventors say: Take one part of coal tar and one part of ordinary naphthalene, and, after raising the mixture to approximately 90° C., blow cold air in a divided condition through the mass. The temperature rises progressively by reason of the reaction alone. A portion of the naphthalene distils pure and without change; the other portion combines, as the result of partial dehydrogenation of the hydrocarbons of the tar, and forms a mixture of hydrocarbons $(C_6H_3)_n$, solid at ordinary temperature, melting between 30° and 70° C., according to the duration of the operation, and representing a pitch of excellent quality. The pure naphthalene obtained by distillation "condenses in splendid snow-white flakes."

Water-Meters, Water-Motors, and Pumps.

Thorp, T., of Whitefield, near Manchester.

No. 29,638; Dec. 20, 1906.

This invention consists in a novel application of U-shaped rolling piston packings—such as were described in patents No. 412 of 1901 and No. 16,404 of 1889—for controlling the distribution of the liquid in water meters, motors, and pumps, and in their construction or arrangement so as to effect the distribution by packings—the object of the invention being to "dispense with sliding or other valves and valve gear and obtain noiseless and frictionless working."

The cylinders are arranged in pairs, and the piston of one cylinder is connected to a crank set at a right angle to the crank to which the other piston is connected. With this arrangement one piston travels at its maximum speed at mid-stroke when the other is at the end of its stroke; and the former can, as is known, be made use of for controlling the admission and discharge ports of the other cylinder, and *vice versâ*. This has been done in the case of ordinary sliding pistons by arranging suitable ports in the pistons and cylinders; but the present inventor uses two or three rolling packages between the cylinders and the pistons, the diameter of which is less than that of the cylinders—the packings enclosing annular spaces round the pistons which act like ports in the pistons for the flow of the water to and from the ends of the cylinders.

Testing Incandescent Gas-Mantles.

Woodall, Harold W., and Moon, P. G. G., of Bournemouth.

No. 651; Jan. 10, 1907.

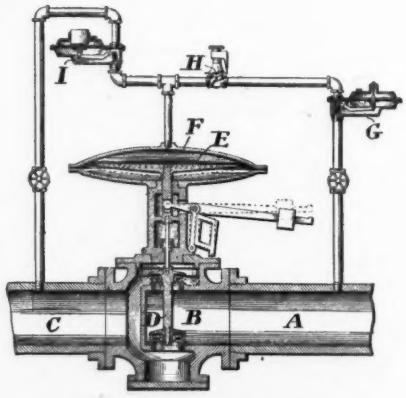
This apparatus for testing incandescent gas-mantles—which was described and illustrated in the "Journal" for Oct. 22, p. 244—consists of a base carrying a standard, a gas supply, and pilot supply to a burner carried by the standard, a gas-cock plug in the standard and controlling the gas supply to the burner (the plug being revolved from some prime mover and operating counting mechanism), cams on the gas-plug spindle, brackets on, or connected to, the standard, and weight-carrying rods held by one bracket and engaging the other. The whole is positioned and actuated so that the gas supply is intermittently extinguished and relighted to effect slight explosions at the mantle attached to the burner; and at the same time the weighted rods are lifted and dropped, to effect a concussion action on one of the brackets to be transmitted to the mantle.

Pressure-Controlling Systems.

Reynolds, M. G., of Anderson, Indiana, U.S.A.

No. 2103; Jan. 28, 1907.

This invention relates particularly to an auxiliary system for controlling the pressure exerted upon the diaphragm of a valve-operating regulator, with the object of controlling the pressure exerted upon the valve-operating regulator so as to maintain a steady pressure in the service mains at all times regardless of the consumption, and to avoid a pressure leak through the regulating system from the high-pressure to the low-pressure main, which prevents a tight closing of the valve under many conditions.



Reynolds' Pressure-Controller.

A is the high-pressure main provided with the valve-casing B (of any ordinary construction) having connected therewith a low-pressure or service main C. Disposed within the valve-casing is a reciprocating valve D, of ordinary construction, the stem of which is connected with the depending stem of the diaphragm E of the main or valve-operating regulator F, by which the valve is moved corresponding to the pressure exerted upon the diaphragm. The diaphragm is also under the opposing pressure of a pivoted lever provided with a weight. The main regulator is connected with an auxiliary system by pipes in communication at one end with the high-pressure main through an auxiliary high-pressure regulator G, of any suitable construction. In that shown, the diaphragm is connected with a pivoted lever carrying a valve, which co-operates with an apertured seat at the discharge from the vertical inlet pipe. The regulator is connected so that the high-pressure operates beneath the diaphragm; while intermediate of the regulator and the connection to the main regulator a needle-valve H is applied—adapted to be operated by a handle in the usual manner. The horizontal connecting pipe is at its opposite end attached to the low-pressure main by a pipe communicating with the weighted regulator I, the diaphragm of which is connected with a lever carrying a valve-block adapted to co-operate with the apertured seat therein.

In the operation of this system with the high-pressure at 25 lbs., for instance, and the low-pressure at 1 oz., the auxiliary high-pressure

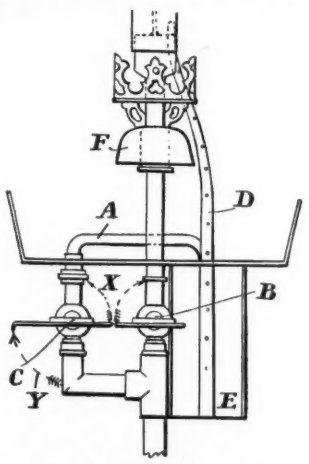
regulator is set to carry 8 oz. of pressure without closing; while the needle-valve is partially opened, so as to allow a small volume of gas under this pressure to pass to the upper surface of the valve-operating regulator. The low-pressure auxiliary regulator is also set to deliver a pressure of 1 oz. without closing; and this regulator is very sensitive—having only 8 oz. to resist through its connection with the high-pressure auxiliary regulator. When no gas is used from the low-pressure main, a slight increase of pressure therein causes the auxiliary low-pressure regulator to close its valve tightly, and stops the flow of gas from the high-pressure auxiliary regulator through the regulator to the low-pressure main. The needle-valve being slightly open, the gas passes to the valve-operating regulator until its pressure increases to 8 oz., which exerts sufficient power to close the valve tightly. When the consumption of gas in the low-pressure main begins, the auxiliary low-pressure regulator will slightly open, allowing the pressure and gas to escape from the valve-operating regulator until it is reduced to a point which permits the lever connection to open the valve. This occurs at a weight pressure, for instance, 3 oz. As more gas is used, this auxiliary pressure slowly reduces, and the valve-operating regulator gradually opens and supplies whatever the demand requires. The pressure between the high-pressure regulator and the needle-valve is constantly held at 8 oz.; and the valve being only partly open causes the pressure beyond it to vary to suit the volume required in the mains, and also the pressure on the valve-operating regulator to vary, for instance, from 3 oz. to 8 oz. as required. At the former pressure the valve-operating regulator is permitted to open to feed from the high to the low pressure main, and at the latter pressure the regulator is operated to close the valve absolutely tight.

Pilot Lighting Device for Gas-Lamps.

MACFARLANE, R., of Dundee.

No. 6179; March 14, 1907.

This invention relates to a device for lighting the lamp by the ordinary lighting rod applied to the exterior, without requiring the lamp to be opened, "with the result that the mantle is always equally protected from draughts and excessive variations of temperature."



Macfarlane's Lamp-Lighter.

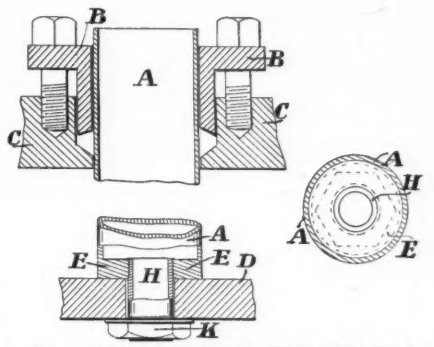
To the bar of the ordinary lamp-case is fitted a bye-pass pipe A connected to the gas supply pipe below the ordinary stop cock B, and provided with an off-and-on stop cock C on the same level. The cocks are placed at a small distance apart, and when shut their lever plates are horizontal. The one cock turns to the right hand and the other to the left, as indicated by the arrows X; the arrangement being such that when the lighting rod is thrust between them both are turned full on. The bye-pass pipe on the inside of the case lies along the top of the cross-bar and leads into an upstanding pipe D at about its middle. The upper portion of this pipe is within the lamp-case, while the lower portion outside is protected by a semi-circular shield E. The upper extremity of the pipe D is open, while at the bottom it is closed. At intervals on the pipe are a series of small perforations; those on the outside being preferably in a slight groove in the pipe, and facing the lighting rod when it is applied. The perforations on the portion of the pipe inside the case are preferably at right angles to those on the outside, and facing away from the burner. Over the air-vent to the burner is placed a bell-shaped shield F, to prevent the pilot-lights igniting the gas at the vents; while at the same time it improves the air supply. The head of the lighting rod is thrust between the two stopcocks (opening both) and placed against the shield E and facing the perforations in the pipe D; thus lighting the jets of gas, which communicate one with the other until the gas issuing from the top of the tube is ignited and in turn lights the main gas-jet. Immediately this happens, the bye-pass cock is shut by the end of the lighting rod pushing it in the direction of the arrow Y.

Tubes of Water Condensers.

BEARD, G. F. H., and R. & J. DEMPSTER, LTD., of Manchester.

No. 13,655; June 18, 1907.

These improvements have for their object to enable tubes of water condensers to be conveniently withdrawn from the bottom plate supporting them, through the top or other end plate, when desired, without affecting the number of tubes which are ordinarily capable of being provided within the area of the condenser. At present, for the most part the water-tubes are formed with an external screw-thread at their lower ends, and pass through clear holes in the bottom plate; each tube being provided with a nut below the plate and a screw-threaded collar above—thus necessitating a manhole above the plate, as well as one below, to enable the collar to be removed before the tube can be withdrawn, and even then it may be necessary to remove several tubes before the collar of the particular tube requiring substitution can be got at.



Beard and Dempster's Connections for Water-Tube Condensers.

The patentees propose to provide the tube A with a welded end E, and a screw-threaded bore therein, into which is screwed a pipe H, of reduced diameter, so as to make use of a smaller nut K than would be the case if it had to embrace the full diameter of the tube. The amount of water usually passed through the tubes of the water condenser at any moment is considerably less than the capacity of such tubes; and the pipe H is provided with a bore sufficiently large for the purpose.

By the means described, it will be seen that the tube can be withdrawn by releasing the nut K merely, and without necessitating any enlargement of the aperture in the plate C.

Various means may be adopted for reducing the diameter of the part on which is screwed the nut K—such as by forming the tube A with a reduced diameter by the bending of the contour of the pipe, so as to form a shoulder above the bottom plate at the same time.

APPLICATIONS FOR LETTERS PATENT.

2645A.—WILKINSON, H. I., JOHNSON, H. C., and TEATHER, J., "Two-stroke cycle internal combustion engines." Dec. 7.

26,560.—THORP, T., "Rotary motors, blowers, pumps, and meters." Dec. 2.

26,590.—BUEB, J., "Gas-furnaces." Dec. 2.

26,593.—RIES, H., "Manufacture of gas." Dec. 2.

26,594.—RIES, H., "Bricks for retorts." Dec. 2.

26,638.—SLOCOMBE, G. F. S., "Gas-stoves." Dec. 2.

26 644.—BARKER, L. C., "Manufacture of producer gas." Dec. 2.

26,717.—WINKLER, H., "Inverted burners." Dec. 3.

26,720.—WINKLER, H., "Inverted burners." Dec. 3.

26,732.—DUGUID, G., "Scraping tubes internally." Dec. 3.

26,764.—HINCH, J., and BROOKS, B. W., "Dust receiver for burners." Dec. 4.

26,779.—CHAMBERLAIN AND HOOKHAM, LTD., and HOLDEN, S. H., "Measuring and consuming devices for gas, electricity, and the like." Dec. 4.

26,809.—STAMM, H., "Lead-seal lock." Dec. 4.

26,814.—EDWARDS, H. E., "Pressure-reducing valves." Dec. 4.

26,830.—CUMMINS, R. E., "Artificial fuels." Dec. 4.

26,842.—LOEBE, H. E., "Pipe-connections." Dec. 4.

26,862.—SLATER, J. S., "Inverted gas lighting." Dec. 5.

26,910.—WILTON, T. & G., "Distillation of tar." Dec. 5.

26,958.—SHEARER, W., "Making air gas." Dec. 6.

26,995.—ALLEN, T. G., "Gas-taps." Dec. 6.

27,014.—ALGIE, A. F., "Acetylene gas plant." (A communication from F. H. Williams.) Dec. 6.

27,040.—HOLMAN, S., "Burner." Dec. 7.

27,054.—NUNNS, H.. "Prepayment meters." Dec. 7.

27,059.—GILLIBRAND, R. T., "Air and gas mixing apparatus." Dec. 7.

27,064 —BRAKEFIELD, W., "Pipe-connectors." Dec. 7.

27,091.—SCHWARZHAUPT, A., "Indicating leakages in gas-pipes." Dec. 7.

27,100.—MARSHALL, H. J., "Rotary pumps." Dec. 7.

27,105.—WILKINS, E. M., "Calibrating or standardizing service meters." Dec. 7.

27,127.—YOUNG, B., "Mantles." Dec. 7.

Gas-Workers' Conditions at Rochdale.—The question of "holidays and wages" was discussed at great length by the Rochale Town Council at their last monthly meeting, in connection with a recommendation of the Gas Committee that a week's holiday with pay should be granted to regular employees, and that proportionate holiday with pay should be allowed to extra men engaged during the winter season, provided they put in at least twenty weeks' work. It was stated that the members of the Committee who supported the proposal did so not so much with the idea that it would be passed by the Council that day, but that it might cause the whole question of holidays to be reopened, and bring about a more satisfactory settlement than was the last one. It did have the effect of re-opening the question; but the recommendation was rejected. Subsequently, however, the whole question of holidays with pay was referred to a Joint Committee, to be composed of representatives of the Standing Committees of the Council, with a view to securing uniformity of action in the different departments.

PARLIAMENTARY INTELLIGENCE.

GAS AND WATER PROVISIONAL ORDERS FOR 1907.

The Board of Trade have issued their report on their proceedings under the Gas and Water Works Facilities Act, 1870, on the past session. It shows that in December, 1906, nine applications were made to the Board for Provisional Orders; five relating to gas, three to water, and one to a combined gas and water undertaking. The amount of capital proposed to be authorized was £250,800 by shares and £76,308 by loan, of which £138,800 share and £42,058 loan capital was for gas, and £112,000 share and £34,250 loan for water purposes. The Gas Orders related to Freshwater, Seaford, Skegness, Twyford (Berks), and Woking district; the Water Orders to Dorking, Herts and Essex, and Mid Kent; and the Gas and Water Orders to New Tredegar.

The principal objects of the applications with regard to gas were as follows: To empower the Freshwater Gas Company, Limited, to raise additional capital; to empower the Seaford Gas Company, Limited, to maintain, continue, and construct gas-works, and to manufacture and supply gas in the urban district of Seaford; to empower the Skegness Gaslight and Coke Company, Limited, to raise additional capital; to empower the Twyford (Berks) Consumers' Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in Twyford and other places in the county of Berks; and to empower the Woking District Gas Company, Limited, to raise additional capital. Three applications—viz., those from Freshwater, Skegness, and Woking—were in respect of undertakings already authorized by Provisional Orders. The remaining two applications were in respect of existing unauthorized undertakings.

There was no opposition to the Freshwater, Skegness, and Woking applications; but objections were lodged against those from Seaford and Twyford. The Seaford application was withdrawn by the promoters; and the objections to the Twyford application were fully heard and considered by the Board of Trade. An Order was granted in each instance (with the exception of Seaford), subject to such modifications and amendments as seemed to be required. In the Twyford Order, a maximum price of 5s. per 1000 cubic feet was prescribed; power being reserved to the Board to alter, after three years, the maximum price, or to substitute a standard price with sliding-scale as to profits. In the same Order the prescribed illuminating power was fixed at 14 candles, and the new model clauses as to testing were included. In the Twyford Order, a clause was inserted limiting the dividend on the original capital to 7 per cent.; and in the Woking Order, following the precedent of previous Orders relating to the same undertaking, a clause was put in providing that the dividends on each class of ordinary shares or stock shall be paid *pari passu* up to 7 per cent. per annum—the original capital being then entitled to a further dividend not exceeding in the whole 10 per cent. per annum.

The principal objects of the applications for Water Orders were: To empower the Dorking Water Company to raise additional capital; and to empower the Herts and Essex Water-Works Company, Limited, and the Mid-Kent Water Company to extend their limits of supply and raise additional capital. All the applications were in respect of undertakings already authorized by Special Acts or Provisional Orders.

Objections were lodged against the the Herts and Essex and Mid-Kent applications. In the case of the latter, the promoters decided not to proceed with so much of the Order as was objected to; and the remaining portion was unopposed. In the case of the Herts and Essex application, the promoters failed to obtain the consent of the Nazeing Parish Council, one of the local authorities concerned; and the application was also opposed by the Metropolitan Water Board. The promoters requested the Board of Trade to exercise their powers under section 4 of the Gas and Water Works Facilities Act, 1870, and dispense with the consent of the Council; and the Board accordingly held an inquiry into the application. It appeared that the Council had no objection to offer, provided that the grant of an Order would not involve any charge upon the rates, and that it would not make it compulsory to take water from the Company. In these circumstances, and in view of the fact that the Epping Rural District Council, in whose district the parish of Nazeing is situated, had given their consent to the application, the Board decided to dispense with the consent of the Parish Council. A clause was submitted on behalf of the Metropolitan Water Board, the object of which was to prohibit the supply of water by the promoters, in bulk or otherwise, within the Board's area, and the taking of water from the River Lea or the sinking of wells in any part of the promoter's limits, except with express authority. The promoters objected to the clause; and the Board of Trade decided not to insert it in the Order, but to leave the decision to Parliament. During the passing through Parliament of the Bill containing the Order, a clause was agreed between the promoters and the Water Board, and was inserted. The application in respect of the New Tredegar Gas and Water Order was unopposed. An Order was granted by the Board of Trade in each case, subject to such modifications and amendments as seemed necessary.

Two Bills were introduced in the House of Lords to confirm the various Orders—viz., the Gas and Water Orders Confirmation Bill (No. 1), to confirm the Dorking, Freshwater, New Tredegar, Skegness, and Woking Orders; and the Gas and Water Orders Confirmation Bill (No. 2), to confirm the Herts and Essex, Mid-Kent, and Twyford Orders. Petitions were lodged by the Hertfordshire County Council and the Metropolitan Water Board against Bill No. 2, in respect of the Herts and Essex Water Order, but were withdrawn consequent upon the insertion of clauses agreed with the promoters (1) relating to the supply of water to public authorities in the County of Hertford, (2) prohibiting the supply of water in bulk or otherwise in any part of the area of supply of the Metropolitan Water Board, and the taking of water from the Lea or the Stort, and (3) prohibiting the undertakers from sinking wells upon lands acquired by them after the passing of the Order, unless specially authorized to do so. There was no further opposition to either of the Bills, and they received the Royal Assent on the 26th of July and the 2nd of August respectively.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Dec. 13.

(*Before Mr. Justice* PARKER.)

Newman v. Weymouth Consumers' Gas Company.

This was a motion for an injunction to restrain the defendants from digging or excavating on their land adjoining the premises of the plaintiff in such a way as to deprive the land of support, and also from digging away plaintiff's soil—in other words, committing a trespass.

Mr. ROMER, K.C. (with him Mr. OWEN THOMPSON), was proceeding to address his Lordship in support of the motion, when

Mr. BUCKMASTER, K.C., for the defendants, said he could not deny that the plaintiff's land had been let down, though not to the extent alleged. No damage had been done to the premises. He was willing to treat the motion as the trial; to undertake not to excavate on the land so as to interfere or affect the right of the plaintiff to support, and not to go upon, dig, or carry away the soil. He would also use reasonable diligence in filling up the hole, having regard to the work being carried on, and afterwards remove the poles and scaffolding. He would also pay the costs up to the present time, and agree to an inquiry to ascertain what damages plaintiff had sustained—taking liberty to pay money into Court in satisfaction of the damage.

Mr. ROMER accepted these terms.

His LORDSHIP thereupon made an order in accordance with them.

COUNTY OF LONDON QUARTER SESSIONS.

SESSIONS HOUSE, CLERKENWELL.—Tuesday, Nov. 26.

(*Before Mr.* R. LOVELAND LOVELAND, K.C., *Chairman, and a Bench of Justices.*)

Metropolitan Water Board and their Assessments.

The hearing of the appeals of the Metropolitan Water Board against the assessments made by certain Unions and Boroughs at the quinquennial valuation of 1905 was resumed to-day; the proceedings being in reference to the appeals entered for the Kent district—Greenwich and Woolwich.

Mr. DANCKWERTS, K.C., Mr. HORACE AVORY, K.C., and Mr. BOYDELL HOUGHTON (instructed by Mr. Walter Moon) appeared for the Water Board. The Counsel for the City of London Union were Mr. BALFOUR BROWNE, K.C., Sir EDWARD BOYLE, Bart., K.C., M.P., and Mr. WALTER C. RYDE (instructed by Messrs. James White and Leonard). Mr. BALFOUR BROWNE and Mr. WALTER RYDE appeared on behalf of the Greenwich Union; Mr. WALTER RYDE, Mr. COX SINCLAIR, and Mr. BICKMORE, for the Woolwich Union; Mr. CUNNINGHAM GLEN and Mr. A. BETHUNE, for the Holborn Union; Mr. MORTEN and Mr. SAUNDERS, for the Borough of Islington; and Mr. C. A. RUSSELL, K.C., and Mr. COURTHOPE MUNROE, for the Borough of St. Pancras.

Greenwich Union and Woolwich Union.

Mr. *W. B. Bryan*, recalled, and examined by Mr. HORACE AVORY, said North Woolwich was supplied entirely by the East London district, though Woolwich was situated in the Kent district. Lewisham, which was also in the Kent district, was principally supplied by the Lambeth Company, a very small part by the Southwark and Vauxhall Company, and the remainder by the Kent Company. Camberwell was supplied partly by the Southwark and Vauxhall and partly by the Kent. Deptford (St. Paul) was mainly supplied by the Kent Company, with a small portion by the Southwark and Vauxhall; and Rotherhithe, mainly by the Southwark and Vauxhall, with a small portion by Kent. He did not agree with the statement that the supply from the wells in the Kent district was sufficient for this area, because he was having to make provision in the future for supplying water there from the Thames. A new main was laid a short time ago connected to the 36-inch main from Nunhead down to opposite the Tower Bridge, so that water could be poured into the Kent district from the Thames supplies. In addition to this, the Board were in negotiation at present with the London County Council for another very large intercommunication.

Cross-examined by Mr. RYDE, witness said it was his statement in the Board's report for 1906 that of the five engineering districts into which the Board's area of supply had been divided, only the Kent district was independent of the Thames and Lea—it being supplied solely from deep wells. He also agreed that the report of the preceding year, as well as that to March, 1906, both showed that the amount pumped in the Kent Company's district was the same to a gallon as the quantity supplied in that district. On several occasions, however, water was pumped experimentally through the intercommunication mains. This was to test the pumping apparatus, so that at a moment's notice, in case of emergency, the Board would have found out the weak spots, and been able to send the water. The new main for Thames water that he had spoken of in answer to Mr. Horace Avory was finished and coupled up, so far as he could remember, two or three years ago.

Re-examined by Mr. HORACE AVORY: This particular main was part of the intercommunication system sanctioned by Parliament six or seven years ago; and at that time the Kent Company had to pay their share of the expense. In other words, six or seven years ago Parliament recognized the necessity of Kent having this means of intercommunication; and witness regarded it as an absolute necessity, in order to ensure the supply to the more populous parts of the district.

Mr. *Frank C. Ryde*, recalled and examined by Mr. HORACE AVORY, produced a table, worked out on his principle for the Greenwich and Woolwich Unions. It showed the gross receipts in the different parishes; and then there was calculated the rateable value, *plus* rates on the productive mains, at 21 per cent. of the receipts. From this was deducted the amount of the rates, which gave the rateable value of the productive mains. To this was added the works and the carrying and pumping mains; and thus was arrived at the total rateable value in each parish. The statutable deductions were then added to give the gross value. The results he arrived at were as follows: Greenwich Union—Parish of Greenwich: Gross value, £6543; rateable value asked for in notice of appeal, £6766; rateable value appealed against, £8435. Parish of St. Nicholas, Deptford: Gross value, £1040; rateable value asked for in appeal, £1210; rateable value appealed against, £1670. Parish of St. Paul, Deptford: Gross value, £15,094; rateable value asked for in appeal, £13,298; rateable value appealed against, £15,124. Woolwich Union—Parish of Charlton and Kidbrooke: Gross value, £2444; rateable value asked for in appeal, £2508; rateable value appealed against, £3154. Parish of Plumstead: Gross value, £6122; rateable value asked for in appeal, £5292; rateable value appealed against, £6717. Parish of Woolwich: Gross value, £3896; rateable value asked for in appeal, £4127; rateable value appealed against, £4810.

Witness was cross-examined shortly by Mr. W. C. RYDE as to differences between the figures given in his table for the unproductive mains and works, and those stated in the case presented by the appellants; the learned Counsel remarking that he should contend that the appellants were bound by the figures given in their own case, and could not go below them.

Mr. RYDE then addressed the Court for the Woolwich Union; saying that he would deal with the main question that was before them—namely, on what principle the works were to be valued, whether as an integral and inseparable part of the whole undertaking of the Water Board or as a separate concern. They had there an undertaking—*primâ facia*, he agreed, one undertaking—and it was a very attractive view at first sight to say that, inasmuch as all the Companies were swept away, and their undertakings were merged in one large Board, now they must value the thing as a whole. But when it was ascertained—as he submitted it had been in the course of this hearing—that the Kent district was practically independent still, then he argued that the case was altered. The Kent district was practically entirely supplied by pumping water from the ground; while other districts were supplied by drawing water from the rivers. The one system involved pumping, and the other storage and filtration. He therefore submitted to the Court that the proper way to value the parts of the Board's undertaking that were worked in these two entirely different ways, was to debit each part with the cost of maintaining its indirectly productive works—in the case of the Kent district, the pumping-engines for the wells, and so on; and in the case of the other districts, the reservoirs, filter-beds, and so on, which were necessary in dealing with river water. Really the question was not, as apparently had been put by Mr. Horace Avory, whether the concern was now one undertaking, because this, of course, only confused the matter, by using an ambiguous word. In a sense, doubtless it was one commercial undertaking. All the profits went into one purse ultimately; but before the profits were ascertained, the gross receipts had to be subjected to deductions for entirely different classes of expenses. He submitted to the Court that these deductions should be made in the parishes and Unions where they occurred, and not by spreading them all over the system, and thereby in some cases increasing, and in others decreasing, the burden which, apart from this combination of the Companies into one Board, would fall upon the different parts. He would like to direct attention to another small point, which was really very instructive. When the Water Companies were in existence, all of them, or at any rate many of them, had a limited dividend; and at the time of the arbitration, most of them were paying their maximum dividends, and had also paid up all the arrears. The West Middlesex Company were one of those who had reached this stage; and when the arbitration began they were actually granting a rebate to the consumers from the statutory charges—that was to say, they were returning 5 per cent. of the rates to everyone who took their water. When the Board came into possession, the question at once arose as to whether they were bound to continue these rebates; and it was decided by the Courts that (being entitled to make the statutory charges, not having any dividends to pay, and not being hampered, therefore, by any limitations as to dividend) they were not bound to grant the rebate. At first sight, this again was a very strong argument for saying that the undertaking must now be valued as a whole; but the contrary result was arrived at when the matter was considered. Supposing the effect of granting rebates to consumers in the West Middlesex district had been to give back to them £20,000, the rebates were got rid of, and thus the net earnings of the West Middlesex area were £20,000 more under the Board than they were under the Company. Now, supposing they had to make a valuation, first, while the Company were in possession, and, secondly, after the Board came along, would it not be manifest that the proper way to deal with the increased net earnings would be by saying: "The Board are now in possession of a property which, in their hands, produces £20,000 more than before; and the value of that property has gone up £20,000?" But the effect of pooling the West Middlesex undertaking with the whole of the other undertakings in Water London had been to spread this £20,000, which was solely earned in the West Middlesex area, over the other districts. The benefit of the elision should be given to the occupier of that area; and he should be taken as earning £20,000 more than the Company earned when they were in possession of the property. For these reasons he submitted that the Court ought to deal with that part of the undertaking of the Water Board (because he was bound to say it was one undertaking in a sense) which was, in fact, supplied with water from wells—which required pumping, but no filtration and practically no storage—by itself. In other words, that they should debit the productive mains with the rateable value, or a share of the rateable value, of the pumping-stations, and such reservoirs (if any) as there were.

The CHAIRMAN said that, in order to arrive at this, it would be necessary to have the whole of the rateable value of the reservoirs and the other parts of what Counsel called the separate undertaking in Kent.

Mr. RYDE replied that Mr. Dinwiddy had given the indirectly productive portion of the works in the district, as per Mr. Valon, at £17,523; and the carrying works, as per his own valuation, at £16,395. This made a total of £33,918, of which £17,523 was already agreed—or rather adopted from the appellants' figures—while the second item was not cross-examined upon. Therefore, he submitted that the Court were in a position to give an alternative finding, enabling the High Court, if necessary, to say that the £33,918 was the indirectly productive value of the Kent district.

The CHAIRMAN: I do not think we shall do anything of the sort. I think we shall find a rateable value for the whole undertaking.

Mr. RYDE (continuing) said he would like to refer to one precedent, as showing his reason for saying that a sounder method of deducting the rateable value for works for the whole undertaking would have been to take the actual assessment. In 1891, there was an appeal by the Gaslight and Coke Company against the City of London and other Unions; and in the report of these proceedings, it was stated: "In arriving at the rateable value of the indirectly productive works, amounting to £250,000, Mr. Ryde"—that was the late Mr. Edward Ryde—"had taken the actual assessments (not appealed against) standing in the valuation lists wherever a separate entry appeared. He also treated all mains with a diameter of 24 inches and upwards as unproductive. This part of the witness's examination was ultimately adopted by the Court." So that the Court there adopted and acted upon a valuation of £250,000, which was based on the principle of taking the actual assessments.

The CHAIRMAN: Wherever he could find them. That is just what has been done in this case.

Mr. RYDE: That is exactly what has not happened. Proceeding, he said Mr. Dinwiddy, in his evidence, gave a comparison with actual assessments (where there were actual assessments) of the figure given by Mr. Valon in the composite valuation which had been placed before the Court. One of the main things Mr. Dinwiddy took as an illustration of the other statements of values by the appellants' witnesses as compared with the assessments in the valuation lists, was the Staines reservoirs. Mr. Dinwiddy had been able to give the assessments from the valuation lists for about 60 per cent. in value of the whole; and he found that on a figure of £225,000 shown in the valuation lists, there was an error of over £80,000, or, roughly speaking, 30 per cent., in favour of the Board. This threw a very strong light on the course the Board had taken. If the case was that some might be too high and others too low, and that matters would thus balance one another, there would have been no necessity to take out a valuation of these £15,000,000 worth of properties. The Board could have taken the valuation lists and been content with them. It was because the Board wanted to deduct more than appeared in the valuation lists that they went to the great expense of having the valuations made separately. They might quite well have done what was done in the case of the Gaslight and Coke Company by the Court itself—adopt the actual assessments where these were ascertainable on the valuation lists. The real difference between the parties, however, was the principle on which the valuation should be based, rather than the details of the valuation. So far from there being anything against the respondents in Mr. Dinwiddy's admission that a valuation made by him on Mr. Ryde's principle would have brought out a lower figure than did Mr. Dinwiddy's valuation on his own method, this only emphasized what was the respondents' case all along—that the principle of the appellants' valuation was erroneous, and the effect of it was to reduce the figure which would stand in the valuation list, notwithstanding the fact that the receipts in the parishes in question had gone up since the last quinquennial. This was the point between them. It was because the Board sought to disturb the existing balance of power, and introduce a new method, that the ratepayers of Greenwich, Woolwich, the City of London, and other places were before the Court. When it was stated that this appeal raised a different question from that raised by any other, he begged to disagree. No different considerations could apply merely because one of the parties, who was himself a ratepayer, raised his money from other people who were themselves ratepayers when they paid their water-rate. In conclusion, he submitted that, if the case had to go to the High Court, he had definitely and clearly raised the point that the Kent district ought to be valued separately from the rest of the Board's undertaking.

Borough of Islington.

Mr. *Frank C. Ryde*, recalled, and further examined by Mr. DANCKWERTS, said he had prepared similar figures for Islington to those submitted for the City and Greenwich and Woolwich—that was to say, founded upon his own valuation. The gross receipts were £98,764. The rateable value, *plus* the rates, of the productive mains, calculated at 21 per cent., was £20,740—28 per cent. was what the appellants were asking for in the case; but 21 per cent. was what they were proving. They were putting forward in this case figures which they knew were amply high. Deducting rates at 7s. 3d. in the pound, £5518, made the rateable value of the productive mains £15,222. The rateable value of the works and the carrying and pumping mains was £14,317. These added together made the total rateable value in the borough £29,539; the figure appealed against being £50,247. The statutable deductions were £7907, leaving a total gross in the borough of £37,446.

In cross-examination by Mr. MORTEN, witness admitted that there was a slight error in his gross receipts for the whole undertaking—some £900. He accepted the correct figure as being £2,761,974, against the figure he had given of £2,761,013. As to his total for working expenses, *ex* rates, £714,543, he included from the Board's accounts £2000 for protection of water, £40,861 for abstraction of water, £25,336 for storage (£30,930, less £5594 for repairs), £30,961 for filtration (£32,306, less £1615 for repairs), £209,723 for pumping and engine charges (£249,891, less £40,168 for repairs), distribution £84,196 (£274,744, less £190,548 for repairs). As to other items, the sum included for the upkeep of the Hertford Sewage Works was paid to keep the water pure. It certainly was not a landlord's charge, nor

were those already referred to, for protection of water and abstraction of water. Superannuations and compensation for the abolition of office had to be considered in the rating, because they were annual charges. The hypothetical tenant could not get out of it. If he did not, he would merely have to increase his salaries. Quite recently in the South Metropolitan Gas Company's appeal, precisely the same sort of thing was done in the way of profit-sharing. He also included the cost of the quinquennial valuation, as the hypothetical tenant would not get through everything without a rating appeal. He had put down an average annual sum of £2000 for cost of re-valuation all over the district. As to the occupier's share, his reason for rejecting as the basis the capital required by the tenant was that it would not give him sufficient return. He took instead 8 per cent. of the gross receipts. In an ordinary case of a water undertaking, the occupier's share would certainly have to be 10 per cent. of the gross receipts; but in the present instance, taking into consideration the magnitude of the concern and the safety of the income, he reduced it to 8 per cent. Though the tenant had no extraordinary risk to face, there was the price of coal and materials generally, and the possibility of a rise in wages. In a railway case (say) 17½ per cent. on the capital employed was a great deal more than 10 per cent. of the gross receipts; and therefore the question did not arise. But with (say) a water undertaking, where there was practically no tenant's capital at all, they must give the tenant an interest in some way; and this was the only method by which he was accustomed to arrive at it. Questioned as to his inclusion of a sinking fund in the statutable deductions, witness said an undertaking like this was not entirely maintained out of revenue. He had never known in any rating appeal by the old Companies, or by any companies, a case where the statutory deductions had not included on both sides a sinking fund for renewals; and in every instance he had come across, it had been on a very much higher scale than he had allowed here. He had taken an average life of sixty years on what he had allowed a sinking fund for—namely, mains and pumping works. He had not allowed a sinking fund for wells, reservoirs, or filters. His total for unproductive works in the Borough of Islington was £6255, and unproductive mains £8062. This came to £14,317.

Re-examined by Mr. DANCKWERTS: A sinking fund had always been allowed in all the appeals of the old London Water Companies; and a very general practice was to put down for the renewal fund 1 per cent. of the total capital. This, on the 3 per cent. table, gave an average life of about 43 years; and as this was always put down on the whole of the capital, it would give an average life of 43 years to the reservoirs, and things like that. In this case he had struck out the reservoirs, filters, and wells abolutely, though the wells themselves would require re-lining eventually. On the other parts, instead of taking a life of 43 years, he had increased it to an average of 60 years.

Mr. *F. E. Harris*, recalled and cross-examined by Mr. MORTEN, said that to keep actual accounts showing the profits in each of the districts would be a matter of impossibility. There would be no difficulty in finding out the revenue in any particular rating area; it was a question of time. The maintenance of mains was not kept distinct for the various districts. There was practically no district accounting whatever. Wages were not kept distinct for the different districts; but they could be separated in the books. The same thing applied to salaries. Invoices were analyzed into districts. Rates and wayleaves there would be no difficulty about. Then there would be the establishment charges; and the difficulty would be to make an apportionment of central expenses which would be fair to any particular district. A proportion of the gross receipts might certainly be adopted for this purpose, if it was considered satisfactory.

Re-examined by Mr. DANCKWERTS: The Statute did not permit them to distinguish expenses in respect of any particular area; and the water was continually changed from district to district. It was still his firm opinion that any differentiation as regarded area of expenses was not a practical working matter.

Friday, Nov. 29.

Borough of St. Pancras.

Mr. HORACE AVORY announced that terms of settlement had been arranged for St. Pancras.

Borough of Islington.

Mr. MORTEN said that since the last adjournment efforts had been made to ascertain from the appellants how their figure of £98,764 for the gross receipts in Islington had been arrived at; but he had been unable to learn how much was for domestic and how much for non-domestic supply. When the proper time came, he should submit that the appellants had wholly failed to prove their case—that the main figure upon which their assessment, so far as Islington was concerned, was based, had not been proved.

Mr. HORACE AVORY pointed out that during the hearing of the City of London appeal, Mr. Morten gave an undertaking that he would not, on behalf of Islington, seek to re-try the whole case, nor any question of general principle that arose over that appeal.

Mr. MORTEN remarked that this figure of £98,764 was applicable to Islington, and Islington alone.

Mr. *F. E. Harris*, recalled and further examined by Mr. HORACE AVORY, said the figure of £98,764 for the gross receipts in Islington was ascertained by Mr. Ryde from the Company's published accounts for the year ending December, 1903. He had had the receipts for 1906 extracted, and they came to £96,019. Search was being made among the old papers of the New River Company for the information desired by the other side; but there had been no result.

Cross-examined by Mr. MORTEN: He accounted for the decreased rental in Islington during the past three years by the fact that the borough at the last quinquennial revaluation did not show anything like the increase of rateable value that was exhibited at the previous quinquennial. Then there had been a large increase in empty property in the district. These two factors taken into consideration proved to his mind that the figures of 1906 were accurate—in other words, that the figures supplied to the respondents for 1903 were, in comparison with those for 1906, perfectly reasonable and accurate.

Mr. MORTEN asserted that the £98,764 ought to be about £109,000.

Cross-examination continued: The £96,019 witness had given as the gross revenue for Islington in 1906 was made up of domestic revenue £77,768, and meter revenue £18,251. Of course, some domestic supplies were furnished by meter.

Mr. MORTEN said he could not accept these figures. According to his clients' calculations—which, of course, could only be calculations based upon the published reports and tables of the Board—the gross revenue ought to be some £10,000 higher than Mr. Harris had put it at; and he therefore asked that his clients should have an opportunity of investigating the figures that had been put before the Court that day. Without this, the Court must act in the dark.

Mr. DANCKWERTS objected on the ground that Islington had already had ample facility offered for going into the matter, and had neglected to take advantage of it.

The CHAIRMAN: You had this figure of £98,764 ten days ago.

Mr. MORTEN: And we found that the figure was for 1903; and on this they were allocating 1906 receipts. They cannot do that. It is not until this morning we had the figure upon which the allocation should really be made; and it is this figure, upon which the allocation is to be made for 1906, that I want to investigate. I challenge it simply because I think I have good ground for doing so when I deal with the proportion which one item of the figure bears to the rest.

The CHAIRMAN: I think we must go on.

Mr. MORTEN: I have made my protest; and I offer to take the expense on our shoulders of investigating the figures given by Mr. Harris. The rates in Islington are now 7s. 3d. in the pound; and the amount of difference between the Water Board and ourselves in this appeal is over £15,000. It means a loss to Islington, if the appeal succeeds, of over £5000 a year. The cases were lodged only ten days ago; and I submit that I am being forced on, so far as my appeal is concerned, without having a proper opportunity—or what I call any opportunity at all, in fact—of investigating the figures that are put forward to-day for the first time.

Mr. *W. F. Dewey*, examined by Mr. MORTEN, said he was Town Clerk and Clerk to the Assessment Committee of the borough and parish of St. Mary, Islington. The assessments for the last four quinquennials prior to this were: 1885, £33,950, with gross receipts of £80,374; 1890, £38,010 (gross receipts untraceable); 1895, £41,450, with gross receipts of £88,219; and 1900, £49,310, with gross receipts of £97,275. All the figures were settlements between the parties. Calculating from the Board's tables for the year ending Michaelmas, 1905, as printed in "London Statistics" for 1906-7, he put the gross receipts in Islington at £108,959. The revenue from domestic supplies based on annual value were in Islington 4 per cent. of the total receipts of the Board under this heading; so he calculated the non-domestic and other measured supplies at a like percentage. There had been nothing to the extent alleged by the Board to account for the alteration claimed in the value of the hereditament.

In cross-examination, witness admitted that the gross revenue from domestic supply based on annual value over the whole area meant that it was the amount which would have been received if all the properties were occupied.

Mr. *H. H. Fuller*, recalled, and examined by Mr. MORTEN, said he had made a valuation of the unproductive works in Islington; and he arrived at a total rateable value for them of £17,033, as against Mr. Ryde's £14,317. As to the productive works, he had made a valuation based on the Board's accounts for the year to March, 1906; and he made it, for the whole undertaking, £888,198, or 32·2 per cent. of the total gross receipts. Applying this to Islington, and taking the gross receipts at the figure given by Mr. Harris (£98,764), he got a rateable value for the productive mains of £23,341; and adding to this the £17,033 for the indirectly productive works and mains, he arrived at a total rateable value for Islington of £40,374. His percentage of 32·2 of the gross receipts compared with Mr. Ryde's 21. In the matter of the sinking fund, he would take an all-round eighty years of life for buildings, mains, and everything; and he thought this was a very reasonable figure, if it was right at all to deduct it. For the occupier's share he put down an equivalent 4 per cent. of the gross receipts, as against Mr. Ryde's 8 per cent. Witness reckoned on a tenant's capital of £700,000, and took 15 per cent. on this. His figure of £40,374 as the total rateable value of the undertaking in Islington was based on its being part of the Board's complete concern. He had also prepared a valuation on the assumption that Islington was not part of one complete undertaking; and this gave a total rateable value for Islington of £58,569.

Cross-examined by Mr. DANCKWERTS, witness said his figure of £40,374 compared with Mr. Ryde's £29,539. In valuing the whole of the concern, he had taken 10 per cent. off Mr. Ryde's unproductive works, which had the effect of increasing the total value of the directly productive mains. He admitted that one way of keeping up the rateable value was to manage so that expenses were kept down. He included as landlord's expenditure the £2000 paid annually to the Lea Conservancy for keeping the water pure, the £4861 paid for the privilege of extracting water from the various rivers, the sum contributed to the Hertford Sewage Works, the cost of the quinquennial valuation, and other matters. The difference between Mr. Ryde and himself on these expenses was £59,244. As to the 15 per cent. he had taken for occupier's share on his assumed tenant's capital of £700,000, in small water undertakings 10 per cent. on the gross receipts was often taken. In the City of London case, he did not allocate the proportion of the directly productive mains according to gross receipts; but in the Islington appeal he had done so—following the rule of the Court. He could imagine, however, that the same ratio would have to be taken in each particular district.

Mr. DANCKWERTS: What we want the Court to fix is the rateable value of the directly productive mains in the whole. Once we have got that, let it be distributed among the parishes.

The CHAIRMAN: We shall give you the rateable value of the whole undertaking, and the rateable value *plus* rates of the productive portion. Then you can fight it out.

Mr. *Samuel Wood*, re-called, and examined by Mr. MORTEN, said that, as an accountant, he could not see any practical difficulty in making out a statement of revenue and expenditure for the New River

district alone from the books of the Board. He had examined the ledger and journal of the Board, and such subsidiary books as he had thought it necessary to ask for. He found that for the year ending Oct. 31, 1906, the income from water rents and charges had been allocated to the various districts as they were now. Maintenance of mains and wages were left separate; and salaries, excepting those brought into the central office, had been analyzed into districts. The maintenance, pumping, and filtration charges were all shown separately. In his judgment, there would be no difficulty in allocating the cost of water. The quantities were known. It cost about 8d. per 1000 gallons throughout the Board's district; and he should think the Engineer could settle upon a figure either above or below this average.

Cross-examined by Mr. DANCKWERTS: He was not told the system of the Water Board was that accounts came through certain districts, whether incurred in those districts or not.

CONVICTION FOR UNLAWFULLY CONSUMING GAS.

At the Blyth Petty Sessions last Tuesday, William Frost, a cycle repairer, was charged with stealing, on the 29th ult., a quantity of gas, valued at 4d., the property of the Blyth and Cowpen Gas Company. Mr. J. Armstrong, an Inspector of the Company, said he visited Frost's place of business, and found a gas-jet burning at high pressure. Farther along the bench, nearer the meter, there was another burner which was not alight. Witness lit it; and the gas burnt with pressure like the other. He then went to the meter and found the gas was turned off. He drew the defendant's attention to the fact; and he replied that the tap wanted "grinding in"—meaning that it was slack, and allowed the gas to pass. If this had been the case, said witness, there could not possibly have been the pressure which he found. He examined the tap, and found that it was all right; but, to make assurance doubly sure, he took the plug out of the tap and placed his finger against the inlet hole. The lights, however, still burnt. This strengthened his opinion that the gas was coming from some other source. Albert Penman, the foreman plumber to the Company, spoke to being called to the defendant's premises by the previous witness, and finding under the bench a ½-inch T-piece on the service-pipe below the meter, a ⅜-inch union, and in it a cork loosely inserted, from which gas was escaping. Defendant's attention was drawn to the cork, which had evidently been recently placed where it was found, and he replied that this was where the meter originally stood when upon the floor. Mr. J. Eadington, the Company's Manager, said the defendant had three lights, an enamelling-stove, a brazing apparatus, and a boiling-ring. He suggested to the defendant that he had been getting gas between the brazing-pipe and the T-piece on the service, and he made no reply. Mr. A. C. Fawcett, the Company's Secretary, produced an extract from the books, showing that from June 16, 1902, up till October last the defendant had consumed 3300 cubic feet of gas of the value of 10s. 4d. His suspicions being aroused, he sent Mr. Armstrong to investigate the matter, with the result given in his evidence. Defendant pleaded not guilty. He said the meter was at one time in a damp place, and he was getting his gas for nothing. The meter was shifted; and the man who fixed it put on a T-piece. He (defendant) subsequently found the gas escaping, and "fixed it up." He emphatically denied stealing the gas. The Bench were satisfied that a serious offence had been committed; and they fined defendant £5 and costs (£1 13s.), or one month's imprisonment. The fine not being paid, defendant was sent to prison. We understand that the defendant's statement about the meter being shifted was incorrect. The meter originally in his premises was tested in September, 1905, certified to be correct, and refixed in the same position. As the defendant's account continued to be very small, the meter was again taken out in June, 1906, and a new one fixed. The same consumption, however, continuing, suspicion was aroused; and the result above reported shows that it was well founded.

OFFICIAL REFEREE'S COURT.—Saturday, Dec. 14.

(*Before Mr.* MUIR MACKENZIE.)

Redman v. Llewellyn and Others.

To-day the Official Referee delivered judgment in this case, which was tried before him at Bradford. He said the plaintiff was an engineer, and the defendants were seven gentlemen trading as Redman's Gas-Plant Syndicate. The plaintiff's claim, as pleaded, was for a balance amount of £610 11s. 4d., alleged to be due, as to part, on agreements made verbally in 1905, giving to defendants an option for a specified period to acquire from plaintiff certain inventions in regard to gas apparatus of which he was, or claimed to be, the patentee, and to buy outright from him his entire interest in respect of these inventions in France, Germany, and Belgium; and as to the other part, for the balance of the price of goods sold and delivered, and for money due for advances and for remuneration for services rendered. At the hearing, the plaintiff's claim was somewhat modified, after allowing for payments made to him, to £175 for the sale of his interest in the foreign patents, £92 8s. for goods sold and delivered, and £173 for remuneration. The plaintiff also claimed three small sums of £6 2s., £5, and £3 1s. 6d. The action was defended by four of the seven members of the Syndicate, who denied liability to pay the plaintiff any of the sums claimed, except the £6 2s. and £5. They pleaded a set-off, and a counter-claim founded on an alleged breach by the plaintiff of an alleged agreement, dated in 1906, relating to the patents and the option, and also founded in the alternative on a claim to be entitled to recover back from the plaintiff the moneys paid to him as on a failure of consideration. Lengthy negotiations took place between the parties, and meetings were held at which the terms for purchasing the plaintiff's patent rights were discussed. Having gone at length into the history of the various meetings and discussions thereat, the learned Official Referee found that there had been nothing but negotiation all through, and therefore the plaintiff's claim to maintain an action on the agreement as pleaded failed. There was a further question—viz., whether, in the events that had happened, plaintiff was entitled to recover the balance of the agreed sum of £2 10s. per patent per month, until the option was determined. As plaintiff had himself determined it, the Official Referee held that he was not entitled to recover the balance. Dealing next with the claim for remuneration, he said this could only be maintained if the plaintiff could prove that the services he had rendered were at the request of the other people with whom he was associated, and whom he was suing. No minute of any resolution awarding the plaintiff any remuneration had been produced, and there was no evidence of any express agreement to this effect; therefore that claim also failed. The next item of claim was the £92 8s. for goods sold and delivered. On this point the question to be considered was whether the goods had been ordered by any of the persons sued by the plaintiff; and he (the Official Referee) found that none of them had done so. This being so, the plaintiff's claim failed except as to the two small sums of £5 and £6 2s., which had been admitted. The last point was defendant's counterclaim, which was founded upon an alleged breach by the plaintiff of an agreement with regard to the patents, and also for the return of certain sums paid to him by defendants. The plaintiff's Solicitors were employed to settle the terms of a draft contract between him and the defendants; but they had no authority to enter into a contract on his behalf without his acquiescence. The Official Referee found that the plaintiff did not acquiesce in the refusal of the defendants' Solicitors to allow the retention of the clause providing for payment in advance, and further that, as a condition of his agreeing to the altered draft, the plaintiff had stipulated for being supplied with certain information which was referred to him. The judgment on this point was that there was no concluded agreement of which the defendants would be entitled to ask for specific performance, or for damages had the plaintiff refused to observe it. Alternatively there was a claim by the defendants on the ground that there was no agreement, and that therefore they were entitled to recover back money which they had paid to the plaintiff or on his behalf. If there had been such a contract as the defendants alleged, and it had been broken, it was possible that the moneys they had paid might be recoverable in the same way as in some cases a purchaser could recover a deposit where the sale went off through the fault of the vendor. But in this case the money was not paid as a deposit on a completed contract; it was paid with full knowledge of the circumstances of the pending negotiations for a contract, which was not ultimately completed, and which the plaintiff refused to enter into because the defendants insisted on a term or terms to which the plaintiff would not agree. The defendants' counterclaim had not been sustained. The result was that there would be judgment for the plaintiff for £11 2s.; and as both sides had failed to make out their case, they would have to pay their own costs.

Claim for Repairing a Gas-Engine.

In the City of London Court, last Friday, before his Honour Judge Lumley Smith, K.C., a claim was made by Messrs. Crossley Bros. and Co., Limited, for £11 16s. 11d. for repairing one of their gas-engines for the defendant, Mr. Stephenson, of Jervis Road, Fulham. The defence was that the work done was useless. Mr. Turrell, who appeared for the plaintiffs, said they supplied a gas-engine to the defendant in August, 1902. In February last he wrote to complain that there was a thudding noise, and he asked them to see what was wrong. Their man found that certain new parts were wanted. They dismantled the engine, and it was decided that they must do the work on Saturday afternoons and on Sunday so that the defendant's business should not be stopped. The plaintiffs did the work, and now made their charge. Mr. J. E. Cooney, the defendant's Solicitor, said that he asked the plaintiffs to remedy the thudding of the engine, which was causing a nuisance to the inhabitants. They sent a man to do the work; but the engine was now worse than ever. Defendant could not use the engine and had had to employ an electric motor with which to do his work. He consequently refused to pay anything. Evidence was given on behalf of the defendant to show that the engine still made an objectionable noise; while for the plaintiffs two experts were called who said that thudding was inseparable from the working of a gas-engine, and that the noise complained of could not be remedied. His Honour said he must find for the plaintiffs for the amount claimed, with costs.

Coke Wheeler Charged with Damaging a Gas-Engine.

Frederick Smith, a coke wheeler employed at the Kidderminster Gas-Works, was recently charged at the Kidderminster Police Court with maliciously damaging a gas-engine at the works on the 28th of September. Mr. Spencer Thursfield, who appeared for the Gas Company, explained that an engine was used to raise trucks of coal up an inclined plane in readiness for use in the retorts; and it was this engine which the defendant was alleged to have maliciously damaged by means of a sledge hammer. The effect of the damage was to stop the engine, and the trucks of coal had to be hauled up by manual labour. A man named Eades, who was working with the accused, and saw him damage the engine, was afraid to disclose how it happened; and though a reward of £2 was offered for the detection of the offender, no one would disclose who caused the damage. A further reward was afterwards offered, with the result that the present proceedings were taken. Alfred Eades was called, and described how the engine was damaged in the valve-spindle, and prevented from running. He said Smith was under the influence of drink at the time. Trouble arose at the works in regard to the affair; and Smith told witness that it would not do for anyone to say anything about it. He was consequently afraid to tell either the foreman or the manager of Smith's conduct. Isaiah Sheldon, a stoker at the works, deposed to hearing Smith ask for a hammer. Other witnesses having been called, Mr. A. Dougall, the manager, gave evidence as to the damage to the engine, and to offering a reward for the detection of the offender. No information was forthcoming, however, and in consequence of the boiler of the pumping-engine being found damaged in a similar manner, the amount of the reward was increased to £5.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Story of the Italian Strike.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, E.C.—Mr. ARTHUR LUCAS in the chair.

The SECRETARY (Mr. W. Martin) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

PROFITS AND EXPLANATION.

The CHAIRMAN, in moving the adoption of the report and accounts, said it would be convenient, in addressing the proprietors, to adopt the usual method at these meetings, and to deal first with the affairs of the Continental Union Company, and then pass on to those of the Union des Gaz. With regard to financial matters, it would be noted from the general revenue account that the dividend received from the Union des Gaz was £61,965, which was £1857 more than last year; and this increase was due to their having received six months' dividend on the 4000 shares of the new issue of the French Company. The profits at Messina and Montargis showed a slight increase—viz., £234. Under the head of interest, the proprietors would see the sum of £4875, which was £1055 less than in 1906—due principally to less interest having been received on the Union des Gaz 4 per cent. bonds, as most of the bonds had been sold in order to pay the first instalment on the 4000 new shares purchased of that Company. The profit for the year showed a decrease of £1028; but, inasmuch as £2000 was carried to a suspense account in connection with the Messina arbitration (to which Mr. Tendron alluded at the meeting last year), the profits for the year were really £972 better than in 1906. To sum up the financial situation, it might be considered satisfactory; for they had maintained their dividend, and the amount carried forward would be increased to £7845, or £1427 more than in 1906. Mr. Tendron, when he addressed the proprietors a year ago, said: "When I tell you it is not at all likely that the dividend will be less, I do not hold out the expectation it will be more; but I do most emphatically say it is exceedingly unlikely to be less." It was a dangerous thing to prophesy; but Mr. Tendron, as the present accounts proved, was quite right, and credit was due to him for his foresight. As for the award of the Messina Arbitrators, it was not satisfactory for either party. The Municipality of Messina had so far not accepted it; consequently, the matter being still unsettled, he would refrain from making further remarks on the subject. With regard to Montargis, in view of certain legislation in France affecting the registration of foreign companies, the Directors had thought it desirable to enter into negotiations for the transfer of the concession to the Union des Gaz. These negotiations were not yet completed; and he could only at present say that they would not be to the disadvantage of this Company. So far as the prosperity of their business was concerned, the increase of over 6 per cent. in the gas sold was a fair advance; but the unfortunate City of Messina had lately been visited by a severe earthquake, which he feared might have injured the Company's mains—to what extent the Directors were at present unable to say. The price of coal had advanced; and he would have something more to say on this all-important point later on. Freights had also risen. But, on the other hand, a rise in the coke sales had, in a certain measure, rendered compensation for the increased cost of fuel.

THE AFFAIRS OF THE UNION DES GAZ.

Regarding the Union des Gaz, he must ask the proprietors to bear with him if his remarks on the affairs of the Company were somewhat lengthy, as the events, since last the Directors met the proprietors, had been of a very grave nature, and had given the greatest anxiety. He had better preface those remarks by stating that the Continental Union Company now held 36,850 of the old 50,000 shares, and 4000 of the new 20,000 shares—that was to say, out of the total of 70,000 shares the Continental Union Company held 40,850; so that it would be seen, notwithstanding the new issue, the Company possessed more than half the shares of the French Company, with a corresponding voting power. With respect to the 4000 new £20 shares which were issued at £8 premium, £5 had been called up; and there would be a call of £5 per share on April 1 next, a further call of £5 per share on July 1, and the final call of £5 would be made probably early in 1909. With this final call, the proprietors would have paid in all £849,000 for the 40,850 shares they held; but he asked them to remember that, inasmuch as the value of the old shares was taken at their face value—that was, £20—their real value was far higher. In fact, in these shares they held a very valuable property, and of a far greater value than the figures in the accounts. Now the prosperity of the Union des Gaz during the year had been great. Whether, in view of recent events in Italy, it would be equally so in the year to come was doubtful; but they were now dealing with the past, and not with the future. As it was, the dividend had not only been maintained, but, after adding substantial sums to its reserves and sinking funds, the Company had carried forward £4676 more than in the previous year. It might be urged that the French Company could have paid a larger dividend. It could; but in face of the rise in the price of coal—a rise which the Directors were bound to provide against—and the unsettled state of the workmen in Italy (necessitating far higher payments for wages and salaries), the Board decided that the soundest course to pursue was to strengthen the reserves as far as possible. He thought that the proprietors would approve of this policy.

THE COAL-TAX AND THE PRICE OF COAL.

In these days, the chairman of every gas company was naturally expected to have much to say on the coal question; but he did not propose to drift into a lecture on this complex problem. He would confine himself to telling the proprietors how it had affected the Union des Gaz. To begin with, it was a bitter disappointment for the Directors to find, when the coal-tax—which, by the way, should never have been imposed, but when imposed should not have been done away with—was removed, that not only would the Company gain nothing by its removal but that the price of coal was rising rapidly. The causes of this rise were no doubt due to the shortage of the output of the French and German mines, coupled with a great demand for coal in Central Europe, which drove the buyers to the English market. The result of the rise was that the coal bill of the Union des Gaz this year showed an increase of £39,000. The German mines were now delivering more coal; and there was every reason to believe that another great rise was not to be apprehended. In the past year, the average rise had been 1s. 10d. per ton; but as the existing contracts would soon end, there would, he feared, be a further increase in the coming year. Fortunately, however, the price of coke had risen; so that they would to an extent receive compensation for the larger outlay.

INCREASED BUSINESS.

The business of the French Company was in a very healthy condition; the total quantity of gas sold showing an increase of about 8 per cent. compared with the preceding year. Putting it another way, the increase in gas sold last year was no less than 288 millions; and this increase showed no signs of diminution. The provision for this great expansion of business led him to the question of capital expenditure.

CAPITAL EXPENDITURE AND WORKS EXTENSIONS—THE VERTICAL RETORT INSTALLATION.

The total capital expenditure of the Union des Gaz during the year was £112,011, and, of course, the greatest portion of this sum had been spent in constructing the new works at Bovisa, near Milan, and Gavette, near Genoa. At Bovisa, the first section, comprising two benches of inclined retorts, capable of producing 2,100,000 cubic feet in 24 hours, was approaching completion, and, in fact, would be at work next month. At Gavette, progress had been made with the preparatory works. A large gasholder had been erected; and a bench of 60 vertical retorts, capable of carbonizing 80 tons of coal per day, would shortly be constructed. He might mention that this was the first time this system of retorts had been adopted by the Company; and the Directors felt justified in erecting them by the very successful results obtained by their use in other gas-works on the Continent. He wished to avail himself of this opportunity to place on record his appreciation of the great ability and energy shown by Mr. A. F. Phillips. As Engineer of the Union des Gaz, he had designed and carried out the construction of these extensive works. But it was not only in Italy that the Union had been obliged to incur further capital expenditure. At Strasburg, the increase in the business had necessitated the enlargement of the existing works in the town and its neighbourhood, and again at Rueil, near Paris, the acquirement of the concessions for the lighting of the four communes mentioned in the report had necessitated the enlargement of the Nanterre works, and in nearly all the other works of the French Company improvements and enlargements were being carried out.

THE STRIKE IN ITALY.

His task that day would be a pleasant one if he could end here with this record of prosperity and expansion; but, alas, he had to allude to the troubles incident to the strikes that took place in Italy early in October, for the proprietors would naturally want to learn more about what happened than they had read in the English newspapers. There had been no acute trouble with the men since 1901. In that year, a very important agreement was signed, not only by the men and the Company, but also by the Municipal and State Authorities; and one of the clauses of this treaty provided that the men's duties, pay, &c., should be defined by a document which in Italy was called an "organico." In February, 1903, this organico was signed by all the parties interested. It assured to the staff very liberal daily pay, with periodical increases every two, three, and four years. Last year further concessions were made to the whole of the staff; and when the men went out, their wages were on a par with, and even above, those of other industrial establishments. In addition, the pensions were on a liberal scale. For instance, a man who retired at 65 received not less than £40 a year; at 60, £35; and so on, according to the wages earned by him. Liberal grants were given in cases of sickness or accident; and it might interest the proprietors to know that the total pensions granted by the Union des Gaz and the contributions made towards the pension fund amounted last year to £17,031, and £7086 was paid to sick workmen. It was a fact that last autumn (eight months after the concessions to which he had referred were made) further demands were sent in, which—for Milan alone—amounted to £28,000; and for the whole of the stations in Italy to £40,000. The Directors were, of course, compelled to reject these impossible requisitions; and in order to make a final effort to avert a strike, a meeting was held on Oct. 6, at which the Municipal Authorities, the representatives of the men, and the Company's Agent (M. Lacombe) were present. At this meeting, pressure was put on their Agent by the authorities to increase the wages by 10 per cent. He intimated his willingness to accede to their wishes; and the meeting was adjourned till nine o'clock the same day for a final discussion on several details. But at six o'clock the men had left their work. Of course, every preparation had been made at Milan and the other cities. Men from the country had been engaged; and men were also sent from France, Germany, and England. It would hardly be believed that, after the Company had, in order to ensure peace, agreed to the wishes of the Municipality, it was only after urgent appeals had been made by M. Lacombe that troops were sent to protect the works in Milan. But at Genoa the authorities gave every assistance; and at Modena and Alessandria, the Managers were able to supply gas. The men remained out till Thursday, the 10th, when—knowing that the Company had a large number of men in the works, and feeling that public opinion was against them—overtures were made by the men, through the Syndic of Milan, and ultimately, during the evening of that day, the men accepted the terms originally offered by the Company—viz., 10 per cent. increase, coupled with the condition that various questions relating to the organico be submitted to arbitration. The proprietors would have read how—after the strike had ended—through a collision with the police, some men were injured. The result was that a general strike was declared, and again the Company's men went out; and work was not resumed till Oct. 13. But even then it was only in a very

desultory manner—the men availing themselves of the slightest excuse to create difficulties, and bring about a further suspension of work. At Messina, he was glad to say, owing to the excellent influence over his men exercised by the Manager (Signor Ruggeri), they refused to go out; and it was satisfactory to know that the authorities expressed their thanks to him for averting the strike. He (the Chairman) had spoken at some length about these painful events, for he wished the proprietors to feel convinced that the Directors of the Union des Gaz had done all in their power to avert a strike, and, when it took place, to meet the wishes of the authorities, and end it as rapidly as possible. As for the demands of the men, they would—so long as the present *régime* lasts—never end; but the men must clearly understand that the Company had reached the limit of its concessions, and that no further advance in wages or salaries would be granted. He felt bound to protest against the action of the Municipal Authorities of Milan during these troubles. Pressure, as he had said, was put on the Company's Agent by these authorities; and as the Company acceded to their wishes, they had the right to expect their moral and material support. The former the Company had never had; and as for the latter, it was only after urgent request that it was partially given, and it was withdrawn as soon as possible. At Genoa, the Company were more fairly treated; and, on behalf of the Directors, he must thank the authorities of that city for the help afforded, and congratulate them on their more enlightened policy. The Company had the right, having strictly conformed to the letter and to the spirit of their contracts, to expect from the State that protection without which the great public service which they carried on could not possibly be properly maintained. The right of employers existed as well as those of employed. In Italy now, the sympathies of the authorities—both State and Municipal—were entirely with the latter; and should further troubles arise (which was possible) the responsibility would rest entirely with those who, having the power in their hands, had not used it wisely, generously, and with justice for the benefit of all classes of the community.

The DEPUTY-CHAIRMAN (Mr. Frederick Tendron) seconded the motion.

Mr. F. J. BUTCHER remarked, with regard to Messina, that he quite understood, under the circumstances arising from an earthquake, they could not just at present expect the authorities to take steps to liquidate their debt of £34,000; but he should like to know what steps were taken before the earthquake to liquidate the arrears.

Mr. CAVE ORME inquired how the distinction between Messina and Montargis with regard to profits was made. They were all put in one account; and it was difficult to know exactly how those towns stood in relation to one another and to the Company.

The CHAIRMAN, in reply, said with respect to Messina, he had constantly from the chair explained the course they had taken to regain the money to which the Company had a just claim. He was happy to say news had reached the Board that day of a very favourable nature. It was that the town of Messina was contracting a loan, and that there was every reason to hope that the whole sum would be repaid next April. Of course, this was not a positive statement. He could only say "hope;" there was no certainty when a town raised a loan. As to Mr. Cave Orme's question, he did not think it was in the interests of the Company he should say what were the exact profits at either town. But he would be glad to give the information privately.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, a dividend of 6½ per cent. on the ordinary stock, and 7 per cent. on the preference stock was declared—leaving for payment, after deducting the interim dividend, 3½ per cent. on the ordinary stock (free of income-tax), and 3½ per cent. on the preference stock (less tax).

Moved by the CHAIRMAN, and seconded by Mr. R. S. GARDINER, the retiring Directors (Mr. F. Tendron and Mr. N. E. B. Garey) were re-elected.

On the motion of Mr. LEONARD R. WILKINSON, seconded by Mr. BERNARD F. HARRIS, the Auditors (Mr. A. T. Eastman and Mr. C. P. Crookenden, F.C.A) were re-appointed.

The CHAIRMAN next proposed that the thanks of the proprietors be given to Secretaries and to the Managers and Engineers of the Continental Union Company and the Union des Gaz, both in London and abroad, for the able services they had rendered during the past year. In his remarks, he said that the year had been an exceptional one, owing to the circumstances to which he had alluded in his speech. Their thanks were due especially to M. Lacombe, the Agent-General of the Company in Italy, who had been in a difficult position, and fully realized the responsibility the Company entrusted to him. Great pressure was put upon him in Italy; and he (the Chairman) was sure the proprietors would sympathize with the difficult position in which he was placed, and the manner in which he had dealt with it. Many of the Company's engineers from the other stations went to M. Lacombe's assistance, and carried good men to him. The thanks of the proprietors were due to those engineers. He must not forget the Secretaries in London and Paris; for during the strike there were daily meetings of the Board, and they were most energetic and of the greatest help to the Directors.

Mr. HENRY BIRCHENOUGH, C.M.G., in seconding, remarked that it was only those who were in weekly and almost daily association with the officers of the Company who really knew how much they were indebted to them for their zeal and loyalty. He knew how great the strain had been upon their officers in Italy; and he knew, too, how admirably they had met their difficulties.

The motion was cordially passed.

Mr. MARTIN, on behalf of the officers and staff at home and abroad, acknowledged the kind words that had been used, and their hearty endorsement by the proprietors.

Mr. L. R. WILKINSON proposed a vote of thanks to the Chairman and Directors. He was sure the proprietors all felt there was a great debt of gratitude due to the Chairman and Directors for the ability they had displayed during the year.

Mr. H. D. ELLIS, in seconding the motion, said he thought that not only were their thanks due to the Board but their sympathies, because they had had an onerous and harassing time to go through.

The motion was heartily agreed to.

The CHAIRMAN, in reply, said it was a great satisfaction to the Board, at these annual meetings, to know that they might count on the support of the proprietors. Owing to the peculiar constitution of the Company, there were practically two companies, and individuals of two nations directing their affairs. It might therefore be expected there would be divergencies of opinion; but he was happy to say there were none. The English and the French Boards were entirely united. The French Board, when they met their English colleagues, gave them their entire support; and were it not so he thought the conduct of this complicated business would be impossible.

This concluded the proceedings.

DEVONPORT GAS UNDERTAKING.

Proposed Increase of Price—Rebuilding of the Retort-House.

There was a long discussion of the affairs of the gas-works at the meeting of the Devonport Town Council last Thursday. The Gas Committee reported that they had had under consideration a list of towns where the price of gas has been raised this year, and a statement showing the effect of the enhanced cost of coal and of the increased price of gas if advanced 2d. and 3d. per 1000 cubic feet. They had resolved that the price be raised by the last-named amount to all consumers (exclusive of those using prepayment meters) from and after the present quarter.

Mr. STROUD, the Deputy-Chairman of the Committee, in moving the adoption of this recommendation, said they regretted very much to propose an increase in the price of gas; but the fact was that they were paying for their coal 3s. 4d. per ton more than at this time last year—16s. 7d. as against 13s. 3d.—and something must be done to meet the increased cost. In Plymouth and several large towns throughout the county, the price had been advanced. He knew that an assurance had been given by the Chairman of the Committee that the price would not be raised this year; but they had come to the conclusion that it was not possible to defer it. It was not intended to alter the cost to slot-meter consumers, who paid 1d. for 25 cubic feet of gas, against 2s. 9d. per 1000 cubic feet which it was now proposed to charge ordinary consumers. If the price were advanced 3d., it would still leave the Committee with a deficit at the end of the year, which, however, they hoped would be made up by the additional amount obtained for coke. Last year the gross profit of the gas undertaking was £19,000 odd, and out of it they paid some £17,000 for interest and sinking fund—leaving £2188 to go to the reserve fund. It was estimated that an increase of 3d. in the price of gas would produce an extra revenue of £3233; and adding to this £2188 from the reserve fund, they had a total of £5421, compared with £5714, representing the increase in the cost of coal. There would, therefore, be £293 to make up from other sources; so that the Committee were not making any excessive demand on the consumers. Nor were they, with the increased price, charging an exorbitant rate; for out of 270 municipalities owning gas-works, only 23 were charging less than the Devonport price of 2s. 6d. If the Council rejected the resolution, they must take the responsibility for the financial result.

The MAYOR (Mr. R. Smerdon) explained that Alderman Hornbrook, the Chairman of the Gas Committee, was in London on Corporation business; and he read a letter from that gentleman in which he said: "I trust the Gas Committee will have the sympathy of the Council. It is not the law of supply and demand that has compelled us to raise the price of gas, but the trusts, combines, and rings—the vultures of mankind."

A MEMBER: And taking off the shilling coal-tax.

Mr. COOMBS, seconding the adoption of the recommendation, said that though they were told that municipal undertakings did not affect the pocket of the ratepayers, it was obvious that directly anything touched the pocket of the Gas Committee they had to come upon the ratepayers—or the consumers, which was the same thing.

Alderman BLACKALL moved that the recommendation be referred back; saying it was an inopportune time for raising the price of gas. If it had been proposed several months ago, when the price of coal was going up, they could have understood it, but coal was now down 1s. or 2s. a ton. It was true the Committee had entered into contracts, and would have to pay the high price for the remainder of the term; but they had a reserve fund on which they could draw for any deficit. The Electricity Committee were also affected by the high prices of coal; but they had made a reduction in their charges. What he was afraid of was that if the price of gas was raised, it would not be easily reduced.

Mr. TOZER seconded the amendment. He said the reserve fund was £5000; and the Gas Committee must use it, as a company would have to do, to make up the loss on the current year. In June last the Chairman of the Committee pleased them by the glowing account he gave of the undertaking. He told them the profit of the year was £19,019, and that out of this £8921 was paid for interest and £8200 for redemption of capital. This really meant that they were freeing the works for the benefit of those who were to follow them; and this was a very strong argument against piling up reserve funds. Alderman Hornbrook promised last June an early reduction in the price of gas, though he must have known then practically as much as they knew now about the cost of coal and what the effect of it would be. Since that time he had come to the Council for an increase of £25,000 in the capital of the undertaking. Now that the tendency was for coal to get cheaper, he did not see why they should advance the price of gas.

Mr. COUSINS supported the amendment, and said that, as a member of the Gas Committee, he had opposed the increase in committee. Perhaps by the time they came to make fresh contracts for coal, the Government would have seen the wisdom of reimposing the coal-tax. In any case, the prospects were that coal would be cheaper.

Mr. ELLIS contended that the calculation on which it was estimated that the loss through the advance in the price of coal would amount to £5714 was fallacious, and said that if the price of gas was to be increased at all, all consumers should share the burden.

Mr. PRYOR contended that, in view of the promise of the Chairman of the Gas Committee not to increase the price of gas this year, the

matter should be deferred until after the close of the financial year in March. He did not see the justice of piling up a large reserve fund when they had to provide for the paying off of the capital in forty years, and he certainly thought they should use the reserve fund to meet a contingency like the present.

Mr. BISHOP, as a member of the Gas Committee, believed the time was inopportune to increase the price. It was the fault of one or two dominant individuals who were not now in the Council that they were paying so high a price for coal. They had an opportunity when coal was cheaper of making a contract for two or three years; but they were overruled.

Mr. BARTLETT said the Committee's desire was that the consumer should pay for the gas, not the ratepayer; but they wished to spare the poorer classes, who constituted the majority of the slot consumers. The Council must not think the Committee were in any trouble. The undertaking had never been in such a good condition as it was now. They were, however, affected by the high price of coal, and were getting rather into a corner with regard to oil, which was also advancing in price, and they were obliged to limit the production of water gas. It was not to the interest of the ratepayers that the amendment should be carried. If the matter were referred back to the Committee, the price could not be advanced in the ensuing quarter.

Alderman P. C. GOODMAN contended that the recommendation should go back to the Committee with the condition that unless they brought up a report showing the sound financial position on the concern, another Committee should be formed. He understood the Manager had proposed that they should fix their coal contracts for a longer period when coal was cheap; but his advice was ignored.

Alderman WAYCOTT, having been a Director of the old Gas Company, said he was always unwilling to criticize the doings of the Gas Committee. He was not surprised that the Council were asked to sanction an increase in price; and if coal were likely to remain at its present figure, he should say the sooner they did it the better. Coal, however, would probably be cheaper; and therefore they might let things remain as they were. He was of opinion that the concern was considerably over-capitalized, and they would have to face this fact.

The TOWN CLERK, in reply to a question, said the reserve fund was £5228.

Mr. MONK submitted that it was the fault of the Council, as a whole, if the gas-works were over capitalized; and it was unfair to give the Gas Committee all the discredit for the position in which the undertaking was placed. As to the contention that the price should be advanced all round, he should like to point out that in no town was the price charged to slot consumers higher than in Devonport. His own view was that as they had a reserve fund of £5000 the Committee would be justified in taking this minute back, and leaving it to the Chairman on a future occasion to defend his promise that the price should not be advanced.

Mr. STROUD said he was willing (it was evidently the feeling of the Council) to take the recommendation back for further consideration.

A vote was, however, taken; and all the members except one voted for the amendment.

In another minute the Gas Committee reported that they had had under consideration plans for extending the retort-house and putting a new roof on it, and had resolved that tenders should be invited from eight firms who make a speciality of roof construction, and that one tender should embrace everything necessary to complete the work.

Mr. ELLIS said he understood the Committee intended to leave the outer wall of the retort-house standing, but to rebuild the front wall and put on a new roof. In his opinion, any independent surveyor would say that the front wall was in an absolutely fit condition to remain. To pull it down and rebuild it would add £750 to the cost—indeed, it might run into four figures. The sole reason for incurring the expenditure was to make the works look pretty. He had examined the wall, and the sole defect visible was one settlement, which was apparently from fifteen to twenty years old, and was not extensive. He moved, as an amendment, that the minute be referred back with a view to placing a new roof on the existing wall.

Alderman SMITH seconded the amendment.

The ENGINEER (Mr. J. W. Buckley) said he had given a great deal of consideration to the question of the retort-house. No one was more reluctant than he to incur capital expenditure, if it could be avoided. He had placed before the Committee something like five schemes; and, after carefully considering them, they were unanimously, with the exception of Alderman Smith, of opinion that the plans before the Council should be carried out. The walls of the present retort-house were built fifty years ago, and were never intended for such a house as they were going to erect. They were about to extend the house right and left, increase the height, and put on a circular roof. Considering the enormous weight of pipes to be placed on the wall, it would be a great mistake to retain the present structure; and if the Council departed from the plans, they must take the responsibility of what might happen in future. There were numerous openings in the wall, and others would have to be made; and, altogether, it was not suitable for the weight it must necessarily bear. His opinion was that it would not add £200 to the expenditure to rebuild the wall. When the house was reconstructed, it would be adopted for any system of retorts they might desire—sloping, horizontal, or vertical—and they could place in it any kind of machinery at present in use.

Mr. BARTLETT thought it a matter for congratulation that the work would be carried out under the supervision of their own Engineer; and the Council would, in his opinion, be wise in accepting his advice. They had had illustrations in the past of the disadvantage of dividing tenders.

Mr. PAUL contended that the examination which Mr. Ellis had made of the wall on one afternoon ought not to be set against the experience of the Engineer.

Mr. BUCKLEY said that, to allay any uneasy feeling that the cost of the wall was to be something very serious, he would suggest that alternative prices should be asked for, and that the tenders should specify the cost of the work with the present wall retained and with a new wall. The Council would then have actual knowledge of what the rebuilding of the wall would cost.

This suggestion was agreed to, and the minute was passed.

BIRKDALE AND ITS GAS SUPPLY.

No time has been lost by Alderman Travis, the Chairman of the Southport Corporation Gas Committee, in replying to the complaints of the gas supply made by a deputation of Ainsdale consumers, and also at a recent meeting of the Birkdale Urban District Council, which were referred to in last week's "JOURNAL," p. 792.

When moving the adoption of his Committee's minutes at last Tuesday's meeting of the Town Council, Alderman Travis said that many years ago, when the Southport Corporation wished to lay mains through Birkdale for the purpose of supplying Ainsdale with gas, the Birkdale Authority did not see its way to grant permission for the pipe to go through their township; the consequence being that an arrangement was made to allow the main to go at the back of Birkdale through the township of Halsall. In addition to this, Ainsdale was supplied with gas through one of the mains belonging to the Birkdale District Council. This was under section 46 of the Act of 1871; and that section, he took it, meant in effect that Southport might supply gas through the main; and if it was not adequate for the proper supply of gas to Ainsdale, the Corporation, at their own expense, might increase the size of the main for the purpose of supplying Ainsdale and any district beyond. He took it also that if the main was not sufficient for the purpose of supplying gas, Birkdale had the responsibility of enlarging it for the purpose of supplying Birkdale. It had been said that Southport must enlarge the main in the Birkdale district, though the Corporation would not reap any benefit from it. If the main was enlarged, it would not merely be to supply gas going to Ainsdale. Birkdale would have the first call upon it, and thus would get the benefit; and it would not be very long before they would again find that the main would be inadequate for the needs of Ainsdale. What the Corporation offered was to put in a separate main from Southport to Ainsdale through the district of Birkdale, which would be used purely for the convenience of customers beyond Birkdale; but for some reason the Birkdale District Council objected to the Corporation putting in this separate main; and the Corporation had no right to lay it without the consent of the Council. The Corporation had not this consent; and while that was so, though they fully acknowledged their responsibility to the gas consumers of Ainsdale, they could not help themselves. Any dispute as to what was the proper proportion that each party should pay, the Southport Gas Committee would be willing to refer to an independent gas engineer selected by Southport and Birkdale; while if they could not agree on an engineer, one should be appointed by the Board of Trade. The Ainsdale deputation stated that on a Sunday evening, and after eleven o'clock at night, when there was not the same draw upon the mains, they were perfectly satisfied with the volume of gas supplied. Therefore it must be a want of pressure they had to complain about. At almost every meeting of the Birkdale District Council they were told that the gas they were supplied with was of 14-candle power or less. Under the Act of 1871, section 40, the Birkdale people had a right to call in a competent man, not being a member of their own staff, to test the gas any day on giving three hours' notice, in order that the Gas Committee might be represented by their Engineer; and if the gas fell below the specified quality, the Committee were liable to a penalty of £20 and costs—Birkdale receiving the £20. When statements like this were made, they must come to one of two conclusions—either that those who made the statements, if members of the Birkdale District Council, did not believe them, and were simply humbugging the gas consumers; or, if they believed them, they were not doing their duty as representatives of the Birkdale gas consumers in not having the Committee fined £20 and costs. Some years ago the Southport Gas Committee were brought before the Birkdale Bench, and fined £20 and costs. Southport appealed against the decision; and the conviction was quashed. Birkdale had to pay all the costs; and Southport received the £20 back again. It was quite true that there had, owing to an accident at the works, been an unpleasant smell with the gas; but steps were immediately taken to put this right. He was quite willing now, and always had been, to meet the Birkdale representatives on that matter in the most friendly way possible; and they could submit any possible difference of opinion to an independent Government authority.

PUBLIC LIGHTING OF PRESCOT.

A short time ago, the Prescot Urban District Council advertised for tenders for the public lighting within their area for a term of five years, from Jan. 1, 1908. In response, the Gas Company sent in a tender for supplying eight 150-candle and 145 75-candle lamps (a total of 153 lamps) for £360 per annum. The Company owning the electricity works—the British Insulated and Helsby Cable Company, Limited—tendered at £383 for 23 arc lamps of 1000-candle power (nominal) and 121 incandescent lamps of 30-candle power, or 40 candles with a reflector, 20 feet from the pillar. The lighting hours are about 3660 per annum—the arc lamps being switched off at midnight, and two incandescent lamps attached to each standard turned on; and the prices quoted included maintenance. At the last monthly meeting of the District Council, the two tenders were considered in Committee, and that of the Cable Company was accepted; the Clerk being instructed to make the term 4½ years only, in order that the contract might not terminate in the middle of winter. On the minutes of the Committee coming before the Council on a motion for their adoption, Mr. Driffield moved, as an amendment, that they be confirmed with the exception of the one referring to the lighting. He pointed out that by accepting the higher tender the Council were voting away £103 10s. of the ratepayers' money; and he said he did not think any case had been made out for incurring this excess of expenditure. So far as he could judge, one contractor would distribute the light of 1000 candles from each of 23 positions, while the other would distribute a total of about 11,000 candles from 145 positions; so that it appeared to him that the matter

required serious consideration from an impartial Committee. Was it not better, in an old town like Prescot, with its narrow and tortuous streets, that they should have a number of reasonably powerful light-points situated in many positions, than have 23 lamps of 1000-candle power each? It was in order that the matter might be fully discussed that he moved his amendment. He considered an injustice had been done to the ratepayers by the action which had been taken; no comment having been made in regard to any dereliction of duty in the conduct of the work in the past, and no impartial and really well-considered scrutiny or comparison having been made between the two schemes. If he could be convinced that the Committee had done the best from a commercial point of view and in the interests of the ratepayers, their proceedings ought to be confirmed. Mr. F. W. Halsall seconded the amendment. Mr. Beesley remarked that the mover of the amendment had stated that no reasons had been advanced for the acceptance of the higher tender. He (the speaker) thought the Council should take into account the extra sum paid by the Cable Company in rates, and the large amount of labour they provided in the town. These matters were worth consideration. Mr. Hemmingway expressed the opinion that the arc lamps added considerably to the dignity of the town, about half the rates of which were paid by the Cable Company; so that they themselves defrayed half the expenses of the lighting. Mr. Driffield said he had attained his object by hearing what had been said, and therefore he was willing to withdraw his amendment. Mr. Halsall having agreed to this, the minutes were confirmed.

A GAS EXHIBITION WITHOUT GAS-WORKS.

A somewhat novel exhibition of gas lighting, cooking, heating, &c., was provided on Thursday last for the residents of New Fishbourne, near Chichester, and lying within the statutory district of the Chichester Gas Company, though up to the present no gas-mains have been laid there. For some days previous to the exhibition, there was naturally considerable speculation as to how it might be possible to hold such a function, where there was no gas supply laid on; and the mystery was in due course fully solved by the arrival of four steel cylinders containing between 200 and 250 cubic feet of compressed coal gas. The exhibition, which had been arranged by Mr. Thos. E Pye, the Gas Company's Engineer, comprised a suitable assortment of up-to-date gas fires and radiators, gas-cookers, grills, and boiling-burners, &c., and various types of incandescent gas-burners, inverted and upright, including clusters of "bijou" burners, with which the hall was beautifully illuminated. The cooking of a dinner, inclusive of a joint, vegetables, and Yorkshire pudding, milk pudding, and cakes, was very successful, and aroused great interest. More than one of the fires was shown in operation, as well as a "St. Andrew" gas-heated steam-radiator; while outside the building an ordinary street-lamp, fitted with a No. 3 "Kern" burner, had been erected to serve as a useful guide to the exhibition hall. Mr. Pye gave a series of short lectures on the advantages of gas from the economic, hygienic, and generally utilitarian points of view—the Rev. R. Baker, the Chairman of the New Fishbourne Parish Council, presiding. Interspersed between the lectures, musical selections, vocal and instrumental, were given, and were much appreciated. Hearty votes of thanks were accorded to the lecturer and his assistants, as well as to the Chairman; and the proceedings were brought to a close with the singing of the National Anthem. Mrs. Pye carried through all the cooking arrangements.

FALLACIES ABOUT THE GAS-STOVE.

[From the "Financial News."]

It is significant that, in spite of the objections advanced against it, upon both hygienic and economic grounds, the gas-stove has proved itself an institution destined to stay. In spite of prejudice, in spite of all the arguments put forward as to the unhealthy condition of the atmosphere in a room heated by a gas-fire, few modern dwellings are *minus* those clever contrivances which become all aglow and give off comfortable heat by the simple application of a match. This is explained, however, by the facts that this prejudice and these arguments have no solid ground, and that the gas-fire has many and obvious advantages. It generates heat quickly, cleanly, and without the dust and dirt inseparable from the ordinary fire-place, and is economical, because the fuel used is strictly proportioned to the work to be done. As to the supposed unhealthiness of gas-fires, this idea is a survival from the days when gas heating-stoves were badly made, badly fitted, and badly used—that is to say, neglected after their first fixing. Properly constructed and properly fixed, gas-fires have proved themselves, and have been pronounced by eminent medical men, to be as healthy as fires whose heat is derived from the combustion of coal and coke. The fact that gas-fires have been strongly recommended by eminent medicos for consumption hospitals is one that should not be overlooked.

The lingering, though rapidly disappearing, prejudice against gas-fires is partly due to the idea that they are not healthy, partly to the belief that they are costly to use, and partly to the fact that very many of those who use them do not have them periodically overhauled and put into good working order, as should be done if the most satisfactory results are to be obtained. When medical men not only preach the use of gas for heating, but also practice what they preach, it is surely safe for the average householder to employ gas in preference to the more cumbersome, more costly, and certainly more dirty and dusty, fuel used by our forefathers. It has been laid down by a well-known medical practitioner that a gas-fire is an essential in every bedroom. The folly in winter of leaving a warm sitting-room to undress in a cold bedroom and get into a cold bed has, he says, been repeatedly demonstrated. "Why don't you have a gas-fire that can be lighted a quarter-of-an-hour before you go to bed, can be turned out as soon as you have undressed, and is ready for use in the morning—causing no dirt or trouble whatever, and very little expense?" And those who have suffered in consequence of such negligence will readily appreciate these words. The advantages of the gas-fire are undoubted, and the utility of gas for cooking purposes cannot be questioned.

A verdict of "Suicide during temporary insanity" was returned at an inquest held last Thursday on a journeyman polisher, aged 65, who was found on the previous morning dead in an arm-chair in the kitchen of his house in Hobart Street, Liverpool, with one end of an india-rubber tube in his mouth, and the other attached to a gas-bracket, the tap of which was full on.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 829.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19–20	..	5 5 0
268,324	10	,,	7½	Do. 7 p.c.	13–14	..	5 7 2
200,000	5	Oct. 30	7	Bombay, Ltd.	6¼–6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½–5	..	5 12 0
50,000	10	Aug. 29	14	Bourne-mouth Gas and Water } B 7 p.c.	16½–17	..	4 2 4
51,810	10	,,	7		14½–15½	..	3 17 5
53,200	10	,,	6	} Pref. 6 p.c.	243–248	..	5 0 10
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	180–185	–2	5 2 8
300,000	,,	,,	9¾	Do. New	115–120	..	4 3 4
52,000	,,	,,	5	Do. 5 p.c. Pref.	98–101*	..	3 19 3
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.	200–210	–5	5 7 1
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	153–158	..	5 4 5
246,320	,,	,,	8½	Do. A. Ord. Stk.	394–4½	..	4 18 5
460,000	20	,,	10	British	116–119	..	5 0 10
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	87–90	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	10½–11½	..	6 4 5
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	8½–9*	..	4 7 11
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.	26–27	..	6 2 3
150,000	20	July 12	8½	Cagliari, Ltd.	6–8	..	—
100,000	10	—	—	Cape Town & Dis., Ltd.	7–9	..	5 0 0
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	48–50	..	6 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	94–96	..	4 13 9
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	108–110	..	4 10 11
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	100–105	..	4 19 0
1,443,280	Stk.	,, 29	5⅝	Commercial 4 p.c Stk.	98–103	..	4 17 1
560,000	,,	,,	5	Do. 3½ p.c. do.	80–82*	+½	3 13 2
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	105–111*	..	5 17 1
800,000	Stk.	,,	6⅔	Continental Union, Ltd.	135–140*	+½	5 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	—	..	—
460,170	Stk.	—	5½	Derby Con. Stk.	—	..	—
55,000	,,	—	4	Do. Deb. Stk.	22½–23½	..	5 2 2
486,090	10	July 31	12	European, Ltd.	16½–17½	..	5 2 10
354,060	10	,,	12	Do. £7 10s. paid	94–96	+1	4 11 7
15,181,590	Stk.	Aug. 15	4⅛	Gas-light and Coke } 4 p.c. Ord.	86–88	..	3 19 7
2,600,000	,,	,,	3⅜	} 3½ p.c. max.	101–104	..	3 16 11
3,799,735	,,	,,	4	} 4 p.c. Con. Pref.	80–32*	+½	3 13 2
4,193,975	,,	Dec. 13	3	} 3 p.c. Con. Deb.	93–98	..	5 2 0
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	114–117	..	5 11 1
82,500	,,	,,	6⅔	Do. do. 5 p.c.	110–120	..	5 0 0
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	167–170	..	4 14 2
4,940,000	Stk.	Nov. 14	8	Imperial Continental	91–93	..	3 15 3
473,600	Stk.	Aug. 15	3⅜	Do. 3½ p.c. Deb. Red.	110–120	..	5 0 0
195,212	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	108–110	..	3 12 9
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A	220–222	..	4 10 1
718,100	,,	,,	7	Do. B	158–160	+1	4 7 6
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	140–145	..	5 5 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd.	4–4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb.	99–101	..	4 19 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 14	3½	Monte Video, Ltd.	10½–11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	106–107	..	4 6 5
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	88–90	–½	3 17 9
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19½–20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13–14	..	5 0 0
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	135–138	..	5 15 11
60,000	5	Sept. 13	7	Ottoman, Ltd.	6–6⅛	..	5 7 8
398,490	5	Oct. 30	7	Primitiva Ord.	6¼–6¾	–⅛	5 3 8
796,980	5	July 31	5	Do. 5 p.c. Pref.	4¼–5⅛	..	4 17 7
488,900	100	Dec. 2	4	Do. 4 p.c. Deb.	92–94	..	4 5 1
1,000,000	10	Oct. 11	8	River Plate Ord.	12⅝–13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	52–94	..	4 5 1
250,000	10	Sept. 27	8	San Paulo, Ltd.	13–13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb.	48–50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	243–245	..	4 1 8
209,984	,,	,,	10	Do. B	243–245	..	4 1 8
523,500	,,	,,	10	Do. C	243–245	..	4 1 8
70,000	10	Nov. 14	10	South African	14½–15½	..	6 9 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	119–121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c	114–117	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117– 20	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120–125	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.	104–109	..	4 11 9
120,000	Stk.	Aug. 15	6¾	Tottenham } A 5 p.c.	120–123	..	5 9 9
398,940	,,	,,	5¼	and } B 3½ p.c.	100–103	..	5 1 11
149,470	,,	Dec. 13	4	Edmonton } 4 p.c. Deb.	97–100*	+½	4 0 0
182,380	10	June 13	8	Tuscan, Ltd.	10½–11	..	7 5 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100–102	..	4 15 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107–109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- } A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6¼	worth } B 3½ p.c.	128–133	..	4 17 9
75,000	,,	,,	5⅝	and } C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney } 3 p.c. Deb. Stk	75–80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	100–103	..	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118–120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk	101–104	..	3 16 11

Prices marked * are "Ex div."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Those who had the privilege, as I had, of attending the visit which the Eastern District of the Scottish Junior Association paid this afternoon to the Corporation Gas-Works in Perth, could have had but one opinion with regard to what they saw. The works which Mr. W. B. M'Lusky is in charge of are new, and have been constructed upon approved principles; but since they were opened in 1901 a good deal has been added to them, which gives them an up-to-date quality that, for their size, places them in the very front rank. A description is given in another column of the newer portions of the plant. The visitors were right cordially received and entertained; Mr. M'Lusky and his assistants, and Mr. R. Hamilton, the Convener of the Gas Committee, devoting the whole afternoon to their service. In one respect, it perhaps ought to be mentioned, Mr. M'Lusky is ahead of all his brethren in Scotland, in that he distils the tar produced in the works. There is a tar distillery in the Provan Gas-Works in Glasgow; but it is worked by a lessee. So far as I know, Perth is the only place where the gas manager is also a tar distiller. As Mr. M'Lusky finds the work to be profitable, his example will probably soon be followed by other managers.

Since it was reconstituted last month, the Town Council of Dundee has been very much perturbed over various matters, the reason for which is probably the election to the Council of some new members, who wish to make their mark in municipal affairs. Several subjects were discussed in heated fashion on Thursday evening. Among them was that of the inquiry which is being held into the affair of the missing cash-box from the Corporation gas office. Mr. Reid intimated that employees in the gas office had presented a petition to Mr. Stiven, the Treasurer, asking that the Committee of Inquiry be augmented. Treasurer Urquhart said the petitioners requested that the Committee be asked to inquire into irregularities which they said were committed by certain members of the staff seven or eight months before, and that the Committee should be increased to seven or eight members. He was willing that there should be further investigation. After some discussion, the number of the Committee was increased to seven.

A state of matters which cannot be a comfortable one for the officials of the Lanark Gas Company, is disclosed by a letter from Mr. Walter Brown, of Lanark, which is published to-day in the "Hamilton Advertiser." Mr. Brown writes that throughout the summer, and even yet, the Gas Company have been denied access to their pipes in the streets, by a small Committee of three of the Town Council, including Provost Macleay, the Convener. Their object, he asserts, is presumably to force the Company to open the streets without their permission, in order that they may be in a position to raise an action against the Company to pay for way-leave. "Till then," he proceeds, "the Committee are powerless, so long as the Gas Company do nothing. They can make no charge; and they cannot sue the Company in Court. Hitherto the Company have refrained from gratifying them by opening the streets, because they do not wish to embark upon a course which may eventually cause the expenditure of a large sum of the ratepayers' money prosecuting and defending themselves (ratepayers against consumers) to increase an imaginary income to the town by taking it out of one pocket and putting it in another. The whole question has arisen out of the Burgh Police Act of 1892, which gives the Town Council a certain control of the streets, but which the Gas Company contend does not apply to them; they having had liberty to open the streets for over sixty years, which cannot be taken from them, and they, being taxed for street-pipes, have the same right in the streets as any other ratepayers. This must also be the feeling in other places, for no burgh for the last fifteen years, as I understand, has thought it worth while to test the question; and I think it would be ill-advised for a small Burgh and a small Company such as ours to try and establish a case for the rest of Scotland, by taking a matter of this kind into Court, to decide what would really be of no value to the ratepayers. Besides, the first decision may not be the final one. Would it not be better to allow the Company to open the streets as formerly, first asking the permission of the Town Clerks, till this business is authoritatively settled elsewhere? Meanwhile the Company's plant is suffering depreciation for want of attention, consumers are inconvenienced and in some degree of danger, and builders are practically at a standstill. The attitude of the Committee is all the more strange, for the town is the second largest shareholder, and the Company's shares are a valuable asset; the £1 share having changed hands recently for £2."

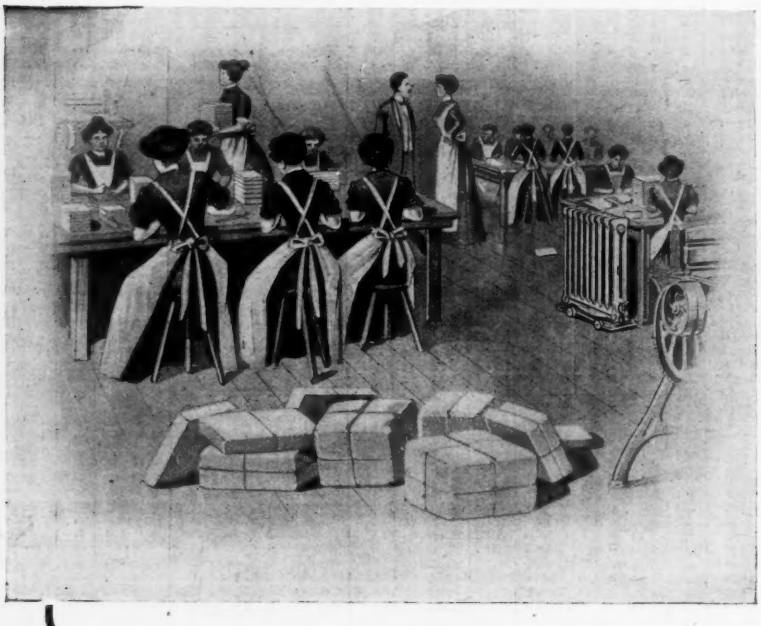
In the Galashiels Town Council this week, the Works Committee re-submitted a letter from the Galashiels Gaslight Company, dated in October, 1905, offering to extend a main gas-pipe to near the entrance to Ladhope House, to where there is at present a main brought from the opposite direction, on condition that the Corporation cut and refill the track, and relieve the Company from rolling and otherwise making good the roadway. The Committee recommended that the offer be accepted, and that three lamps be erected along that part of the road. After a discussion, the recommendation was adopted.

The Broughty Ferry Town Council on Monday indulged in a discussion about the quality of the gas recently supplied. It was explained by the Convener of the Gas Committee that the peculiar behaviour of the gas a few nights before was due to a breakdown in the machinery. Mr. Penman wondered whether the breakdown could have been the reason why the gas was so bad a week or two previously. Bailie Sim pointed out that, according to an unrescinded resolution of the Council, the gas should not be of less illuminating power than 22 candles; and he demanded the reason for the departure from this standard. Several members spoke about the inadvisability of supplying gas of more than 20-candle power now, when so many incandescent gas-burners are in use; and the fact that they had been obliged to economize, on account of their having to wipe off the existing deficit, was also commented upon. The malcontents having had their say, without having accom-

RADIATOR PICTURES

(continued).

WORKSHOP HEATING.



Wright's "ST. ANDREW" Gas-Heated Steam Radiators

have been adopted all over the country for the heating of **WORKSHOPS.**

Below will be found the names of **THREE** of the **LARGEST WORKSHOPS** in London in which Wright's Latest Method of Heating has been adopted.

Bryant & May's.
Waterlow & Sons.
Star Newspaper Co.

WRIGHTS THE RADIATOR PEOPLE.

plished any purpose, the minutes of the Gas Committee were adopted by eight votes to four. The minutes showed the gas supplied during the past month to have been 19·72-candle power. The prescribed standard is 18 candles; and the Corporation aim at supplying gas of 19 candles.

The Tayport Town Council on Monday unanimously adopted the motion, of which notice was given a month ago, that inquiry be made into the advisability of acquiring the business of the Ferry-Port-on-Craig Gaslight Company, Limited, and working the same for and on behalf of the community; and they appointed a Committee to make the inquiry and to report.

The Water Committee of the Aberdeen Town Council had before them on Tuesday an account by Mr. Charles Hawksley, of London, for services in connection with various reports regarding the water supply of the city, and proposals for obtaining a new supply. Mr. Hawksley has reported, since 1901, upon the Dee, the Avon, and other sources of supply; and the subject is still before the Water Committee. The account submitted amounts to £1500, of which £800 is charged as fees, and the balance as personal expenses. The Committee agreed to recommend that the account be paid.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 14.

Sulphate of Ammonia.

Again a very quiet market has to be recorded, with prices still tending downwards, notwithstanding a substantial further increase in exports to the end of November. The anxiety of makers to market their current unsold production has tended to confirm buyers in their waiting attitude, and to depress values. The closing quotations are consequently £11 15s. per ton f.o.b. Hull, £11 16s. 3d. to £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. In the forward position, there has been a fair amount of inquiry, but buyers' views are barely up to the level of spot prices, while makers' ideas are substantially above that level. There has, however, again been speculative selling at the equivalent of £11 15s. per ton f.o.b.

Nitrate of Soda.

This article is also very quiet; the spot prices being 10s. 10½d. and 11s. 1½d. per cwt. for 95 per cent. and refined qualities respectively.

LONDON, *Dec.* 16.

Tar Products.

Tar products continue quiet in tone, with little business doing. Pitch is still quiet for near delivery, and makers have evidently some further quantity to sell for January-June delivery. On the east coast, values are not much over 21s. per ton, and about the same figure on the west coast. In London, where makers are rather better sold, somewhat higher prices are asked. Low figures have been accepted on the Continent for both prompt and forward delivery. Creosote is steady. In London and the North it is still being sold at reasonable prices for prompt delivery; but in the Midlands, makers are particularly well sold, and quote 2⅞d. to 3d. all round. Benzols are quiet. Nineties are steady, but without very much demand; while 50-90's are still neglected, as is toluol, for which there is little request. Solvent naphtha continues quiet and difficult of sale. Crude carbolic is quiet, and low prices have been accepted for both prompt and forward delivery. Crystals still remain below the parity of the crude article, and makers compete very keenly for any orders which come into the market. Anthracene is neglected. Creosote salts are in good demand.

The average values during the week were: Tar, 13s. 6d. to 17s. 6d., *ex* works. Pitch, f.o.b., London, 23s. to 23s. 6d.; f.o.b., east coast, 21s. to 21s. 6d.; f.a.s., west coast, 20s. to 21s. Benzol, 90 per cent., casks included, 8¼d. to 8¾d.; North, 8d. to 8¼d.; 50-90 per cent., casks included, 8d. to 8⅛d.; North, 8d. to 8¼d. Toluol, casks included, 10d.; North, 9¼d. to 9⅜d. Crude naphtha, in bulk, 3⅜d. to 4d.; North, 3⅛d. to 3⅜d.; solvent naphtha, casks included, 11d. to 1s.; North, 9⅛d. to 10¼d.; heavy naphtha, casks included, 11d. to 1s.; North, 10¼d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 2⅛d. to 2⅜d. Heavy oils, 3⅛d., in bulk. Carbolic acid, 60 per cent., casks included, east coast, 1s. 7¼d. to 1s. 7½d.; west coast, 1s. 6⅛d. to 1s. 7¼d. Naphthalene, £6 10s. to £12 10s.; salts, 42s. 6d. to 45s., packages included and f.o.b. Anthracene, "A" quality, 1⅛d. to 1¾d., packages included and delivered; "B" quality, unsaleable.

Sulphate of Ammonia.

This article remains quiet, with little demand for prompt delivery; while for forward makers' present ideas are above what dealers are prepared to pay. The principal London Companies quote £12 5s. in any position, and are particularly well sold. Outside London makers cannot obtain over £11 15s. to £11 17s. 6d. upon Beckton terms. In Hull and Liverpool, markets remain quiet at about £11 15s. to £11 16s. 3d. and £11 16s. 3d. to £11 17s. 6d. respectively. In Leith, the value is about £12 2s. 6d.; but there is practically no business doing. Makers here are known to be very well sold.

Cost of Public Lighting in the Metropolis.—At the meeting of the Camberwell Borough Council last Wednesday, a report by the Borough Engineer was presented, showing that in the year 1904-5 (the last twelve months for which complete returns were available) the average cost of street lighting in the 28 Metropolitan Boroughs and the City of London was £183 per mile; whereas in Camberwell during the same period the cost was only £89 per mile. The highest cost in any division of the Metropolitan area was £488 per mile; while the lowest was £75. Three boroughs had a lower and 25 a higher cost than Camberwell. The majority of those with a higher cost per mile had the main streets, or some of them, lighted by electricity. In Camberwell the lighting is done wholly by gas.

THE BRADDOCK PATENT "SLOT" METER

FITTED WITH

COLSON'S Patent

CASH BOX.

A COMPLETE SAFEGUARD AGAINST THEFT.

PARTICULARS UPON APPLICATION.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, OLDHAM,

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The general conditions governing the coal trade no doubt influenced Lord James of Hereford last week in awarding the 5 per cent. further advance in wages to the Miners' Federation. The coal trade has long been at the flood. Coal is in constant request for all purposes for which it can be used. It is higher in price now than can be remembered in the past. It is not only wanted here, but in other countries. The foreign demand displays no signs of abatement. During the week just ended, the shipments from Hull alone to the Continent showed an increase of something over 30,000 tons compared with the corresponding week of last year. While prices at present show no alteration at the pits, it cannot be surprising if coalowners, after Lord James' decision, and the higher rates of carriage now being charged by the Railway Companies, raise the prices of their products.

Northern Coal Trade.

There is a strong demand for coals, as is usual just before one of the chief holidays, and the shipments have not been much impeded; while the output at the collieries has been generally heavy. The steam coal trade shows a full inquiry for best Northumbrians at 15s. 6d. per ton f.o.b., second-class steams are quiet at about 14s., and steam smalls are very plentiful and rather weaker in price at from about 7s. 6d. to 8s. In the gas coal trade, the demand is now at its fullest; and as the supply is adequate, the quantities sent out are very heavy. Durham gas coals vary in price, according to the quality, from about 12s. 9d. to 14s. 6d., with the usually slight addition for "special Wear" gas coals. Some small lots are now being sold for export over next year; but prices vary—about 13s. 3d. f.o.b. being spoken of as the accepted figure for one lot of good second-class Durhams. It would appear that there is more competition for such orders, and that some buyers seem to be holding for easier terms. Coke is dull, and gas coke is now plentiful, with weaker prices inland. For export, gas coke is quoted at from 19s. to 19s. 3d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade is quiet, with prices tending to get easier. Foreign trade is especially stiff. For home purposes, there is a good demand for splint, and for small stuffs for manufacturing purposes, though forward orders for the latter are difficult to get. The prices quoted are: Ell 14s. to 15s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 3d., and steam 13s. 6d. to 13s. 9d. The shipments for the week amounted to 282,138 tons—an increase of 20,645 tons upon the preceding week, and of 17,527 tons upon the corresponding week of last year. For the year to date, the total shipments have been 13,878,129 tons—an increase of 734,997 tons.

Stourbridge and the Ownership of the Water-Works.

An application having been made to the Board of Trade by the Stourbridge Water Company for an extension of their powers, the Urban District Council held a special meeting to consider the question of safeguarding the interests of the town. Mr. Cook proposed that steps be taken to oppose the application, with a view to the insertion in the Provisional Order of a purchase clause in favour of the Council; and, further, that a small Committee be formed to deal with the matter. The motion having been seconded, Mr. Nash expressed the opinion that the time was opportune for entering into negotiations for acquiring the water-works. The back-dividends of the Company were now paid off; and he believed also that the loans had been all dealt with. Now that the Company were applying for extended powers, he saw no great reason why either the Company or any one else should oppose the acquisition of the undertaking by the town. There was at the present time, he thought, sufficient income from the water-works to pay the maximum dividends on the shares that were issued. He suggested that the Council should appoint a Committee, and arrange an interview with the Directors, with a view to coming to terms. Mr. Taylor, while hoping that an amicable settlement could be made, said he was prepared to advocate going to any length at the present juncture in order that the town might obtain the works. Mr. Fiddian said he would be glad to support the proposition, except that he felt the Council in so doing might be sanctioning the expenditure of a large sum of money on opposition which might prove futile. Mr. Selleck thought the Council should not shrink from incurring expenditure, when it was a question of acquiring what they felt was desirable for the benefit of the district. The Clerk said the Provisional Order of the Company would be deposited on Dec. 23; and at their monthly meeting on Dec. 30, the Council might decide on their action, in time for the lodgment of an objection before Jan. 15. Resolutions were then passed that steps be taken to oppose the application for extended powers by the Water Company, and that a small Committee be formed to carry this out and to negotiate with the Company; and that the Clerk obtain information for submission to the Council as to the inclusion of a purchase clause in such Provisional Order.

Cardiff and the Merthyr Water Bill.—At a meeting of the Cardiff Water Committee a few days ago, a letter was read from the Merthyr Corporation stating that they were promoting a Bill in Parliament next session to obtain powers for the purpose of making an impounding reservoir in the Taff Vechan Valley, which would contain 8,300,000 gallons of water available for sale; and the Town Clerk of Merthyr inquired whether the Cardiff Corporation would enter into an agreement to take a supply of water in bulk. He stated that the Merthyr Corporation would agree to supply, for any term of years from 21 to 50 or over, water filtered or unfiltered, at a flat-rate or a rate proportionate to the average daily supply. A supply of 500,000 gallons daily could be given forthwith. It was agreed that the whole Committee should act as a Sub-Committee to consider the matter.

For Christmas Cheer.

Placed **FIRST** on the List of Eight best Stoves **FOR EFFICIENCY** in special

scientific tests by the Smoke Abatement Society.
(*See* "JOURNAL OF GAS LIGHTING," *Nov. 20, 1906.*)

A GAS FIRE OF DISTINCTION.

Nothing more cheerful than A

"CANNON" "IRIS" GAS FIRE.

Ask for Illustrated Lists, free on Application.

Manufacturers:

CANNON IRON FOUNDRIES, LD.,

DEEPFIELDS, Nr. Bilston, Staffs., Eng.

London Office and Show-Rooms:

Bath House, 57-60, Holborn Viaduct, E.C.

Australasian Agents:
JAMES HURLL & CO., Ltd., 20, Loftus Street, SYDNEY,
and Box No. 4 (G.P.O.) Dunedin.

Serious Gas Explosions.

Early on Sunday, the 8th inst., a serious explosion of gas occurred at the residence of Mr. J. James, 89, Park Street, Slough. It took place in the front sitting-room, and appears to have been caused by an escape of gas from an old-fashioned chandelier from which the water had evaporated; the gas being ignited at a bye-pass. The front of the house was completely wrecked, particularly the sitting-room; but fortunately no one was injured. On Thursday morning there was an explosion of gas at the Knighton Workhouse, which unhappily resulted in the death of Mr. R. M. Butler, the Master. It appears that he was seeking with a candle the cause of an escape of gas in the vicinity of the large meter in the paupers' waiting-room. On opening the cupboard in which the meter is situate, an explosion took place, the force of which was so great that it blew out the wall dividing the waiting-room from the relieving officers' room, and completely wrecked the floor of the Board-room. Mr. Butler was subsequently found seriously injured under the *débris;* and he died about an hour afterwards. On the same day, a serious gas explosion partially wrecked the grocery stores of Burgons, Limited, at Grimsby. Escaping gas had accumulated in an upper room, and on an assistant going in with a naked light an explosion occurred which brought down the shop ceiling and blew the large plate-glass windows out into the street, sending with them a strange collection of hams, groceries, and Christmas fruits. Luckily, the assistants were only shaken, though the damage to the premises and stock was considerable.

Price of Gas and Water at Widnes.

In the course of the proceedings at the meeting of the Widnes Town Council reported in the "JOURNAL" last week (p. 792), a member stated that the cost of gas was a little more than 11d. per 1000 cubic feet, while the price to the consumers was just 11d., so that they were getting their gas below cost price. The statement caused so much discussion in the town, that Alderman Timmis, the Chairman of the Gas and Water Committee, at the monthly meeting of the Council on the 9th inst., asked to be allowed to put before the members the figures by which the minimum charges were arrived at. It was true, he said, that gas cost 11¼d. per 1000 cubic feet to make, and was sold for power at 11d.; while water was produced at a cost of 3d. per 1000 gallons and was sold for 2d. But these prices were permitted as a matter of policy. The net cost of gas was 11⅝d. per 1000 cubic feet. They had up-to-date works, and a great deal of money had been sunk in plant. The lighting time in the town represented about six hours, which meant that for only six hours out of the 24 were they earning money. The larger the quantity of gas passing through the mains, the greater would be the reduction in the cost all round; therefore they could well afford to supply it at a lower cost, and yet at a profit to themselves. In consequence of this low charge, 77 gas-engines were using supplies during the day. With respect to the water-works, the consumption of water was 21 million gallons per week. The reservoir at Pex Hill cost £40,000, and held 12 million gallons of water. The Committee decided that, instead of spending more on storage, it was far better to leave the water in the natural reservoirs in the earth, and lay out the money on more efficient and powerful pumping plant. They had spent £10,000 on the well, and £15,000 on duplicating their engines, and by this means they could offer water cheaper. It was only the surplus over a certain number of millions of gallons used at works that was sold for 2d. per 1000 gallons, so that the practice worked out well. This was really good business; and at the Council meeting at which the arrangement was discussed, it was agreed to unanimously.

Proposed Gas-Works Extensions at Rhyl.—At last week's meeting of the Rhyl Urban District Council, the Gas Committee recommended that application be made to the Local Government Board for sanction to borrow £7889 for extensions at the gas-works. The concern was purchased in 1893; the price being £35,000. The present value, based on last year's profits, is given as £80,000. In two months, half the period for repayment will have passed. In view of anticipated expenditure on public improvements, the recommendation was deferred for further consideration.

No Increase in the Price of Gas at Wandsworth.—At the meeting of the Wandsworth and Putney Gas Company in August last, the Chairman (Mr. H. E. Jones) stated that the authorities in the district had always met the Company very reasonably and fairly; and, in consequence of this and the general position of the Company, the Directors were refraining from raising the price of gas at present. We hear that the Directors have decided to still continue the price of 2s. per 1000 cubic feet, which will therefore remain the lowest in London or the neighbourhood. It will be remembered that the Company also give 15 per cent. discount for gas used for power purposes—making the price about 1s. 8½d. net.

Public Lighting of Camborne.—The question of the improvement of the lighting of the town was considered at a meeting of the Camborne District Council last Friday. Mr. Cadwell, the Chairman of the Lighting Committee, stated that the Gas Company had been asked to give an estimate of the cost of providing and lighting 250 lamps, which was an addition of 50 lamps, for a period of seven or ten years from Aug. 1, 1908. In reply, Mr. W. Bailey, the Secretary of the Gas Company, stated that the Directors were willing to extend their mains; and, provided the contract was for ten years, they would supply the 250 lamps, under similar conditions to those now existing, for £2 12s. 6d. each per annum. Mr. Passmore thought that, as the price of coal was now high, the terms of the contract should be subject to revision at the end of five years. The Rev. Father O'Loughlin suggested that an alternative price for the extra lamps should be obtained from the Electric Supply Company. The meeting discussed the matter at length, and rejected an amendment by Mr. O'Loughlin in favour of asking the Electric Supply Company to tender for the additional lamps. Mr. Caldwell was instructed to continue the negotiations with the Gas Company, with the view of making a contract for ten years, subject to revision at the end of five years, on a sliding-scale according to the price of coal.

ELEGANCE

IN

LIGHTING

FOR THE

HOME, OFFICE

&c., &c.

"B" No. 8D.

"B" No. 8B.

"B" No. 9B.

"A" No. 6.

These are a few of the well-known

'BLAND' LIGHTS.

The New Catalogue

gives a great variety of these and many Illustrations of the Latest and most Elegant Designs in

FITTINGS.

80 Candle Power.
3 Cubic Feet per Hour.

NO Lighting Back.
NO Dirty Fittings or Ceilings.
NO Trouble.

IMPORTANT.

We have frequently reproduced the opinions of Experts; it may now be interesting to give specimens of our Daily Post to indicate the

PUBLIC VIEW

of this wonderful Burner.

Mr. WALTER WICKS, Grocer, 191, Trevelyan Road, Lower Tooting, S.W., says:—

"I have had one of your 'Bland' Lights in use for TWO YEARS, and as I have thoroughly tested it, it may be of interest to know that it has saved me during that period 9200 cubic feet, which works out at the rate of 16s. 1d. per year."

BRITANNIA LAUNDRY, 109, Bollo Bridge Road, Acton, W., says:—

"The No. 7 Burner gives a splendid illumination."

Mr. L. B. PITTIN, "Amycot," Alma Road, Carshalton, says:—

"I purchased some of your Burners 3 weeks since, which give great satisfaction."

Mr. ROBERT WALKER, "Ashmount," Hyde, says:—

"I am highly pleased with the three Inverted Burners and beg to place another order with you."

SEND FOR

NEW CATALOGUE.

BLAND & CO.,

London & Manchester.

London Show-Rooms—
63, Queen Victoria St., London, E.C.

Manchester Show-Rooms—
20, Fennel St., Corporation Street.

Suggested Purchase of the Garw Water Company's Works.—At a recent meeting of the Penybont Rural District Council, Mr. Nicholls suggested that a request should be sent to the Ogmore and Garw Rural District Council asking them to confer with the Penybont Council as to the advisability of the two Authorities jointly acquiring the Garw Water Company's undertaking. He understood there was a strong feeling in the Ogmore and Garw district that this should be done. Mr. Davies seconded, and said it was true that the ratepayers of the Ogmore and Garw district had rejected a scheme which included the purchase of the water-works by their Council alone; but perhaps they would be willing to support the scheme that was now suggested. The motion was carried.

Metropolitan Gas-Meters, Limited.—The eighth annual general meeting of this Company was held at Winchester House, E.C., on Monday last week. Mr. L. R. de Fonblanque in the chair. In moving the adoption of the report, he said the result of the past year's working was a net profit of £1479, compared with £550 for the preceding year. The reconstruction expenses, amounting to £3000, had now all been liquidated, and the loss incurred in the early years of the Company had been reduced to £1000, which he hoped would be wiped out in the course of the current year, if matters went satisfactorily. Taking the last three years under review, the sales showed an increase of 70 per cent. over the first year of the period. These results were, he considered, extremely encouraging, showing as they did that steady and consistent progress was being made. Mr. Lowcock seconded the motion, and it was carried.

Charge for Water at Sevenoaks.—As the result of inquiries, Mr. A. Grainger, the Secretary of the Sevenoaks Water Company, wrote informing the Urban District Council that the Company did not feel justified in reducing the charges for water at the present time, as the revenue was not more than sufficient to maintain the rate of dividend that had been paid for the last two or three years, and to which the shareholders were entitled. The Board, however, proposed to reduce the charges as soon as the net income exceeded £4000 per annum (the present rate), and 5 per cent. on any additional capital that might be issued. The Water Committee recommended for adoption a resolution contending that the present high rate of charge—viz., 7½ per cent. on the rateable values—should be considerably reduced, even though it might involve the reduction of the maximum dividends now being paid to the shareholders; and that something should be done to reduce it at a given date. They also thought that all payments in respect of back-dividends might in equity henceforth cease. The motion was adopted.

The Apportionment of Watershed Areas.—Referring to the recent decision of the Metropolitan Water Board to take steps to provide supplies from the Thames for as long a period as is economically practicable, and to the alarm expressed that authorities throughout the kingdom are appropriating water-supply areas with insufficient heed to the requirements of "other populous places," the Editor of the Engineering Supplement to "The Times" says: "The time is approaching when a complete survey of our water resources will be as necessary as the trigonometrical survey of the country; and the work should be carried out upon national lines. Meanwhile, there is much to be done by users in preventing waste; for there is no doubt that in the Metropolis, and elsewhere in England and Wales, the amount of water lost by leakage and by wantonness is excessive. The logical course of procedure would seem to be for the experts to make their tests first, and for the Water Boards to formulate legislative measures upon the results. To legislate upon ill-considered particulars must necessarily lead to aggravation of the existing anomalies of water supply."

Threatened Strike of Gas-Workers in Dublin.—According to the "Freeman's Journal" for last Friday, a dispute has arisen between the Alliance and Dublin Consumers' Gas Company and some of their employees; and at a meeting of the Gas-Workers' Branch of the National Amalgamated Union of Labour on the 11th inst., the following resolution was unanimously adopted: "That this meeting of 149 (Gas Workers') Branch of the N.A.U.L. deeply regrets that the Directors of the Alliance Gas Company have refused to recognize the representative of the Union to negotiate the just and reasonable demands submitted to them for consideration; and as the Directors of the Gas Company have refused to meet a deputation to discuss our claims, and have shown no inclination of conceding them, we, the employees of the Alliance Gas Company, hereby instruct our official delegate to give notice to the Directors of the Alliance Gas Company, on our behalf, of our intention to cease work on the 19th day of December, 1907, unless the Directors agree to comply with our demands or agree to receive a deputation, which must include their Union representative, to discuss the men's application now before them." It is to be hoped that wise counsels will prevail.

Lincoln Water Supply.—At the Lincoln Guildhall last Thursday, an inquiry was held on behalf of the Local Government Board by Dr. A. W. Brightmore, M.Inst.C.E., into an application by the City Council to borrow £1229 for the purpose of purchasing land at Bracebridge Heath as a site for a reservoir in connection with the Council's water undertaking. Mr. W. T. Page, jun. (the Deputy Town Clerk), stated that the Council's water area was 14,573 acres, and comprised the city of Lincoln and the parishes of Bracebridge Heath, Greetwell, and Skellingthorpe. It was proposed to purchase 8 acres of land at Bracebridge Heath, at £150 per acre; and the provisional contract had been entered into. It was intended to construct a service reservoir to hold 6 million gallons of water. The daily average consumption now was 2 millions; but the Council wished to provide not less than 3 million gallons per day. Mr. W. Watkins raised a strong protest against the Corporation spending so small a sum of money as that asked for as part of a scheme of which the ratepayers and householders of the city knew nothing. It was fair that the Corporation should let the ratepayers know what their scheme was; and he asked the Inspector not to report in favour of granting the sum applied for, but ask that the Corporation should produce their scheme and the estimates for it. Mr. Page denied that there had been any secrecy whatever in the matter, and stated that the scheme which it was desired to carry out was perfectly well known, and had been advertised.

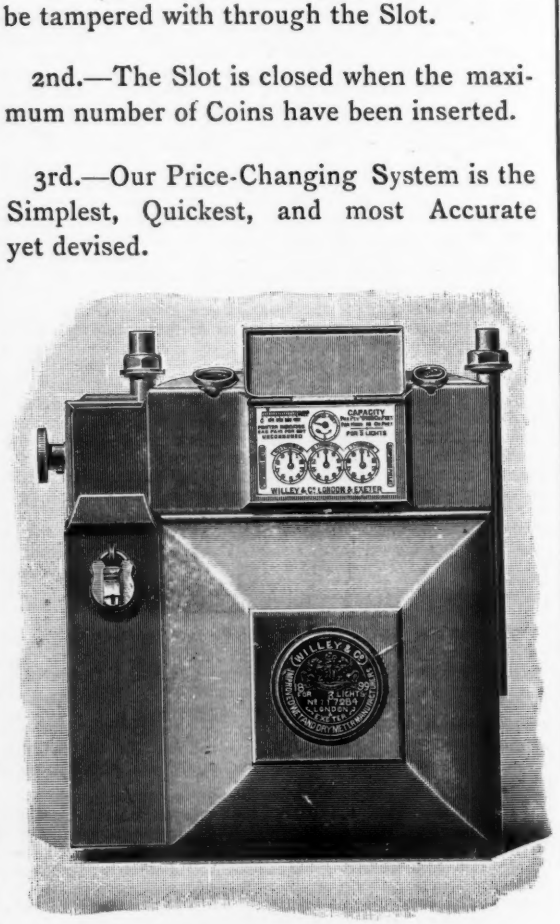
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

AGENTS FOR SCOTLAND:

D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

Belfast Gas Committee and Ormeau Park.—A public meeting has been held in Belfast to protest against what was termed the "proposed destruction of Ormeau Park by the erection of a gas-works thereon." Alderman M'Cormick, in moving a resolution embodying the object of the gathering, said that the opposition to the proposal of the Gas Committee [which was outlined in last week's "JOURNAL," p. 791] would not be confined to the Corporation; for, if necessary, they would go with the matter to Parliament. It was decided that a deputation should wait upon the Parks and Cemetery Committee, and inform them of the resolution that had been passed.

Wages and Holidays at Oldham.—The Oldham Gas Committee, having further considered the application made on behalf of the retort-men, meter-inspectors, and labourers for an advance of wages to the retort-men and meter inspectors, and holidays with pay for these men and the labourers (*ante*, p. 800), have decided not to recommend any alteration in the rate of pay now in force for retort-men and meter inspectors. The Committee say they do not feel competent to take isolated action with regard to the holidays question. At present the dividing line is that men paid a daily wage and receiving pay for over-time work are not paid while away on holiday; while those having a fixed weekly wage and no standard rate for overtime are paid during holiday absence. A meeting is to be convened of all the Corporation Committees employing labour, in order that a common understanding may be arrived at on this matter.

The Mayor of Newport, Isle of Wight, has just had the satisfaction of imparting to the Council of the borough the fact that the last of the stipulated repayments on account of the loan of £12,000 for the water-works has been made by the Water Committee.

At the Bristol Police Court last Friday, Charlotte Herridge was fined 10s. for surreptitiously obtaining a supply of gas for a bracket in her shop without it passing through her prepayment meter. The quantity taken was only 100 cubic feet, of the value of 3d.; but the Company deemed it advisable to prosecute, as there had been similar cases, and it was their desire to put a stop to the practice.

At the Loughborough Police Court last Wednesday, Mr. Perkins, the Town Clerk of Loughborough, appeared to enter into recognizances to prosecute an appeal to the Quarter Sessions against a rate levied by the Shepshed Urban District Council on the Blackbrook reservoir. The rate was levied on £1080, which the Corporation considered was incorrect, this being the full assessable value, whereas the rate should only be levied on a quarter of that amount.

The Waltham Abbey and Cheshunt Gas Company, after trying for several years about twenty of the appliances of the Automatic Light-Controlling Company, Limited, are having all their lamps in both districts installed with the system of automatic controllers; and the Basingstoke Gas Company are installing the system on all the lamps in their area of supply. In the first instance, the slow-ignition controllers are being used; but in the latter, those for quick ignition.

It is reported that a water famine is affecting several areas in Preston, owing to a species of fine moss having found its way into the water-mains, and then into the service-pipes of many houses.

In order to meet the increased demand for mantles consequent upon the extension of incandescent gas lighting, the Aktiengesellschaft für Gasgluchlicht (the United Chemical Works, Limited) are now carrying on their manufacturing operations in fine buildings in a new block which has been put up in Berlin at a cost of £100,000. It is equal to accommodating 3000 workpeople and producing daily 300,000 mantles.

According to the "Daily Express," a new Company is being formed to acquire the Ocean Coal Company, Limited, the second largest coal-producing Company in South Wales, and Messrs. Wilson, Sons, and Co., Limited, one of the largest export and foreign coal companies in the world. The joint undertaking will probably rank as the largest of it kind. Its capital will be £3,500,000. Mr. David Davies, M.P., will be Chairman of the new directorate. The two firms will be worked separately as before. The Ocean Company are reported to own eight large collieries, employing 10,000 men; while Messrs. Wilson, Sons, and Co. own thirteen coaling stations abroad.

In the "Electric Lighting Memoranda" in the "JOURNAL" for the 23rd of July last, reference was made to the "puffs" of the Osram metallic filament lamps which had just appeared in the "Standard" and other papers. Use of these "puffs" is being freely made in the provincial papers; and one recently appeared in the "Aldershot News." It was followed the next week by an even more conspicuous advertisement by the Gas Company, who showed, in a very striking way, that for a light obtainable for 7s. 9d. by gas a consumer adopting electricity, and using the "latest electric lamps," would have to pay £1 9s. 2d., or £1 1s. 5d. more. People must be strongly enamoured of the electric light to pay so dearly for it; and we doubt whether there are many of them at Aldershot.

The annual dinner of the West Greenwich Gas-Works Institute was held on Saturday evening, at the Institute, Roan Street, Greenwich. Mr. J. F. Braidwood, the Engineer-in-Charge of the Greenwich station of the South Metropolitan Gas Company, presided; and among those present were Messrs. H. Austen and C. T. Drumgold (Directors of the Company), several of the chief officials, and Mr. A. Showell, the Hon. Secretary of the Institute. The Chairman proposed "The South Metropolitan Gas Company;" and Mr. Austen, in acknowledging it, referred to the marvellous success of Sir George Livesey's scheme of Co-partnership. He mentioned that during the year the employees of the Company had taken up stock to the nominal value of £35,500, which was a record. The Company had 5200 co-partners, and they had distributed £45,000 among their employees during the year; making a total of £391,000 since the adoption of the scheme in 1889. The other toasts were "The Chairman," and "The Editor of the Company's 'Journal.'" Various prizes for games were distributed during the evening, including the Sir George Livesey cricket shield; the West Green eleven having come out top of the South Metropolitan Cricket League.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SECRETARY AND GENERAL MANAGER (WATER). No. 4882.
GAS MANAGER. Woodford, Ruabon.
WORKS CHEMIST. No. 4884.

Situations Wanted.

MANAGER OR REPRESENTATIVE. No. 4872.
CHIEF COLLECTOR, OR ASSISTANT SECRETARY, &c. (GAS AND WATER). No. 4880.

Plans, Drawings, &c., Prepared. No. 4883.

Plant (Second-Hand), &c., for Sale.

BOILER. Redditch Gas-Works.
COMPLETE GAS PLANT. "Express" Office, Windsor.

Representatives Open.

COAL. Lefebvre, Paris.
GAS ACCESSORIES, &c. No. 4881.

Stocks and Shares, &c.

GREAT WIGSTON GAS COMPANY.

Company Meeting.

THE CRAYS GAS COMPANY. St. Mary Cray Library. Jan. 1. 6.30 p.m.

TENDERS FOR

Coal.

COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 4.

Iron and Steel Work, &c.

SHEFFIELD GAS COMPANY. Tenders by Jan. 7.

Retort-Bench Fittings, Mouthpieces, Hydraulic Mains, &c.

SHEFFIELD GAS COMPANY. Tenders by Jan. 7.

Tar and Liquor.

BRECON GAS COMPANY. Tenders by Jan. 1.
BRIDGEWATER COLLIERIES COKE-WORKS. Tenders by Dec. 23.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated advt. will appear on Dec. 31.
APPLEBYS LIMITED.
58, VICTORIA STREET, WESTMINSTER, S.W.
Telephone: 369 WESTMINSTER. Telegrams: "MILLWRIGHT" LONDON.

"VITERNUS" METALLIC PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

THE KEITH LIGHT.
4800 INSTALLATIONS NOW IN USE.
SEE illustrated advertisement in next week's issue.
JAMES KEITH AND BLACKMAN CO., LTD., 27, Farringdon Avenue, LONDON, E.C.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 7, Park Square, LEEDS.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market,
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

RETORT CARBON—I buy all qualities and Supply the Trade.
Write V. DASNIÈRES, 10, St. Mary Axe, LONDON, E.C.

SULPHURIC ACID.
SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Re pairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

A WELL-KNOWN Gas Engineer requires Position with a good Firm as MANAGER or REPRESENTATIVE.
Address No. 4872, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PLANS, Drawings, Specifications, and Estimates prepared by Experienced Engineer and Draughtsman for all kinds of Gas-Works Plant, Steel Buildings and Structures, and General Machinery.
Address No. 4883, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AN Engineer possessing the best References, and having numerous Connections among Manufacturers and Directors of Gas-Works and large Works for the production of Electric Motive Power, is desirous of REPRESENTING, in Paris and the Department, a First-Class Firm of Coal Merchants.
Address, M. ENG. LEFEBVRE, 3, Rue D'Alger, PARIS.

TO Manufacturers and Importers of Sundries for the Gas Trade. A Firm doing business with the leading Gas Companies and Corporations in the United Kingdom are open to REPRESENT, on Commission, Makers and Importers of Accessories for the Gas Industry.
Address No. 4881, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CHIEF Collector (Water or Gas). Gentleman (Age 35), at present engaged with important undertaking, and showing High-Class record for Initiative and Ability in every Department (including Court Claims), desires CHANGE indicating better opportunities for Advancement. The matter of an Appointment as ASSISTANT-SECRETARY or SUPERINTENDENT of Collectors would also be treated in confidence or through Solicitors.
Address No. 4880, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.
SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD., with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

BY adopting Cripps's Bye-Pass Valves inside your Purifiers, you can relieve the Back-Pressure in the Lower Tiers when the Purifying Material gets hard. They are extremely useful and economical.
Sole Makers: C. & W. WALKER, LIMITED, Midland Iron Works, Donnington, near Newport, SHROPSHIRE.

WANTED, for Water-Works in North Wales, an Efficient and Energetic SECRETARY and GENERAL MANAGER, capable of taking entire Book-Keeping, Rate Collection, Superintending Extensions, and General Management of Company. Previous Experiences necessary.
Apply, in own handwriting, stating Qualifications and Salary required, to No. 4882, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Manager for Gas-Works at Dolgelley, North Wales. Make of Gas, about 6 Millions. Coal business. House, Coal, Gas, and Water free.
Apply, with *copies* of recent Testimonials, stating Wages required, whether Married and what Family, and when duties could commence, to GEO. E. WOODFORD, RUABON.

WANTED, a Works Chemist for a Suburban Gas Company making 300 Millions per Annum. Applicants must be thoroughly conversant with Gas Testing and Modern Gas-Works Analysis, including Coal Testing. Also Tar and Ammoniacal Liquor Distillation, Gas Calorimetry, and the other duties appertaining to that Department. Applicants to state when duties could be commenced.
Applications, to be sent in not later than Friday, the 27th inst., stating Age, Experience, and Salary required, to No. 4884, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO Gas Managers, &c., Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes, and if Wets or Drys. Scrap Metals, Drosses, Metal Shop Sweepings, &c., also bought.
J. WILSON, Pleasant Grove, York Road, King's Cross LONDON, N.

CORNISH Boiler for Sale. 12 feet long by 4 feet diameter, fitted with Meldrum's Dust Fuel Furnace, and complete with all fittings. All in First-Class Condition. Cheap.
The above is removed from its seating, and can be Inspected Internally, and Externally, and is ready for Immediate Disposal.
Further Particulars from ALBERT E. LAYTON, Manager, Gas-Works, REDDITCH.

TO BE SOLD, Cheap, a small Gas Plant, in Excellent Condition, from a private house now supplied by Gas Company's Main.
One small Gasholder, 20 feet diameter, with 10 feet Lift, Four Cast-Iron Columns and top Lattice Work Girders; Two 3-inch Plug Iron Cocks for Inlet and Outlet of Holder; One Bed of Two ⏢ Retorts, 6 ft. by 15 in.; One Bed of ⏢ Retorts, 6 ft. by 13 in.; Three 4-inch Ascension Pipes; Three 4-inch H pieces; One Hydraulic Raise, Cast-Iron; Two Bar Furnaces; Two Purifiers (cast), 3 ft. by 2 ft. each; One Set of Four Condensers, including 4-inch H pieces; One Washer, 3 ft. 6 in. by 2 ft. by 18 ft.
For further Particulars, apply by letter to "N.J.P.," *Express* Office, WINDSOR.

BRECON GAS COMPANY.
TENDERS are invited for the Surplus TAR and LIQUOR produced at these Works, delivered into Tank-Waggons at Brecon Railway Station, for One Year ending December, 1908.
Probable quantity, 120 Tons of Tar and 250 Tons of Liquor of varied strength.
The Directors do not bind themselves to accept the highest or any Tender.
Separate sealed Tenders to be delivered, addressed to the Directors of the Company, on or before Tuesday, Jan. 1, 1908.
WM. A. WRIGHT,
Secretary.
Brecon, Dec. 11, 1907.

GREAT WIGSTON GAS COMPANY.
SALE of Five £100 Debenture Bonds at par, carrying 4 per Cent. interest, payable Half Yearly, terminable by Six Months' Notice either side.
For full Particulars, apply to
JOHN A. HARRIS
Secretary and Manager.
Wigston.